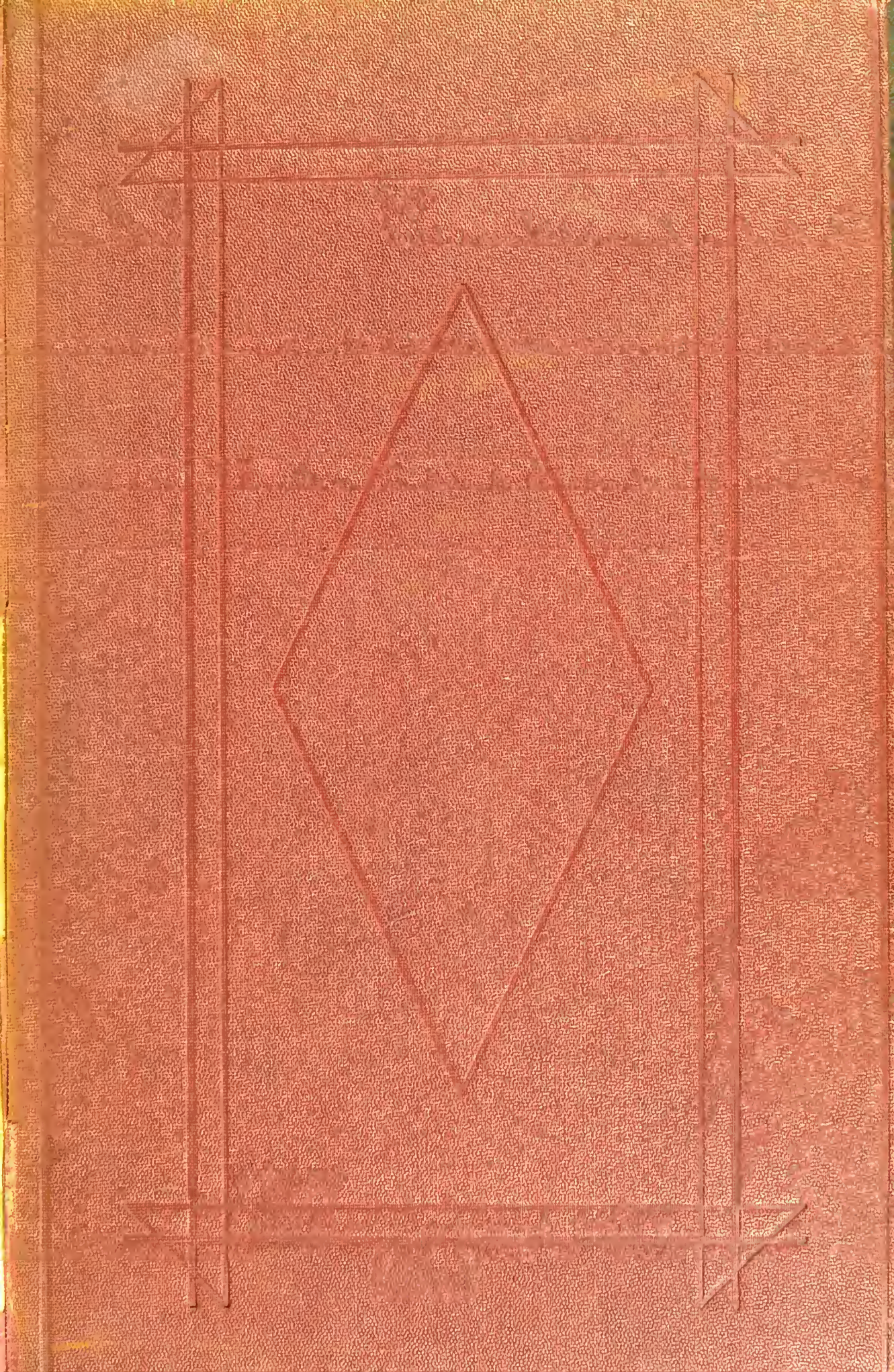




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ON PYAEMIA ,OR SUPPURATIVE ...
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ON
PYÆMIA OR SUPPURATIVE FEVER,
BEING
THE ASTLEY COOPER PRIZE ESSAY
FOR 1868.

BY
PETER MURRAY BRAIDWOOD, M.D., L.R.C.S. EDIN.

LATE PRESIDENT OF THE ROYAL MEDICAL SOCIETY OF EDINBURGH.



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TO THE
PHYSICIANS AND SURGEONS OF GUY'S HOSPITAL,

AND TO
JAMES SPENCE, Esq.,
PROFESSOR OF SURGERY IN THE UNIVERSITY OF EDINBURGH,

THIS WORK IS DEDICATED
AS A TOKEN OF GRATITUDE AND ESTEEM

BY
THE AUTHOR.

“ PRESENTLY THROUGH ALL HIS VEINS THERE RAN
A COLD AND DROWSY HUMOUR, WHICH DID SEIZE
EACH VITAL SPIRIT.”

P R E F A C E.

My aim has been to treat the subject of the present work in detail. My conclusions as to the nature of *Pyæmia*, or, as I prefer to term it, *Suppurative Fever*, are based on a careful study of cases. From among many cases which I have met with, I have selected twenty for special observation, as presenting great diversity and affording an almost complete view of the subject.

The term *Suppurative Fever* appears to me to be preferable to the current appellation *Pyæmia*, inasmuch as the former name refers to Pathological conditions which are constant and characteristic of the disease; while the term *Pyæmia* is connected with a theoretical origin of the affection now considered to be incorrect.

More accurate knowledge of a disease, is, I think, acquired by clinical observation than by experimental research; hence, while not neglecting the latter, my endeavour in the following pages has been faithfully to describe the symptoms and pathology of *Suppurative Fever*, and to draw correct inferences from these re-

garding its nature, origin, and proper treatment, without hazarding baseless speculations. Therefore, placing little reliance on experiments which, in such a question as the present, more readily mislead than guide the observer, I have made only a very few, in order to satisfy myself upon certain points.

The evidence derived from carefully watching during life the cases described, has, as far as is possible, been confirmed by post-mortem examinations, the results of some of which are represented in the accompanying coloured Plates. The cases themselves occurred during the years that I acted as Resident Surgeon in the Edinburgh Royal Infirmary and in the Cumberland Infirmary.

BIRKENHEAD, *October* 1868.

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ON

PYÆMIA, OR SUPPURATIVE FEVER.

CHAPTER I.

HISTORICAL REVIEW OF THE SUBJECT.

IN the following sketch of the writings of various authors who have devoted attention to the subject of *Pyæmia*, or *Suppurative Fever*, it will be remarked that the several views which have been held correspond to the general standard of medical knowledge which existed at the time. Hippocrates considered pyæmia from the stand-point of theory, based on observation of the disease in the human subject. When more time and attention were devoted to the pathology of disease, we have Morgagni, John Hunter, Montezzia, and others, drawing their conclusions from this new source ; and though they misinterpreted the pathological lesions which they carefully and accurately observed, a step in advance was thus made. During the last fifty years, those who have written in detail on suppurative fever have been very numerous ; but the chief progress made in the knowledge of this disease has been attained by the introduction of experimental research :—viz., since the year 1829.

Hippocrates, who flourished in the time of the Peloponnesian War, speaking generally of milk-fever, glanders, phlebitis, &c., considers them "as resulting from the defective powers of the natural emunctories in the expulsion of noxious principles capable of producing disease." He says further, "that those to whom fire is applied for abscess of the liver, (εμπυοι,) recover health if the pus evacuated is white and pure, for this is contained in the membrane which covers the liver; but if this pus resembles the dregs of oil (αμοργη), they die."*

Aretæus lived during the middle of the second century of the Christian era. In his remarks on pneumonia, *Aretæus* observes that the subjects of this disease die mostly on the seventh day. "In certain cases," he says, "much pus is formed in the lungs, or there is a metastasis from the side if a greater symptom of convalescence be at hand. But if, indeed, the matter be translated from the side to the intestine or bladder, the patients immediately recover from the peripneumony."† He speaks of metastasis to the kidneys and bladder being peculiarly favourable in empyema. He ascribes suppuration of the liver to intemperance and protracted disease, especially from dysentery and colliquative wasting. The symptoms described by him resemble those of chronic pyæmia.‡

Nicolaus Massa (1553) mentions a case of abscess of the left lung, following an injury of the head.§

Ambrose Paré (1582) first taught that secondary abscesses in surgical cases were due to a changed con-

* Mémoires de l'Académie de Chirurgie, 1819, tom. iii. p. 451.

† *Aretæus*. Lib. ii. cap. 1.

‡ *Aretæus*. Lib. ii. cap. 28.

§ *Massa*, N. "Introductio Anatomica," cap. 28. Quoted in *Alexander's Translation of Morgagni's Works*, pp. 100, 101.

dition of the fluids, produced by some unknown alteration in the atmosphere, and determining a purulent diathesis. He observed the urine to become purulent after the suppression of external suppurations, and to reassume its primary limpidity when the wound began to furnish pus.* A similar observation was made by Andral, in 1826.† Valsalva (1707) was induced by his own observations to say that the viscera of the thorax were sometimes affected in wounds of the head.‡

Boerhaave (1737), and his commentator *Van Swieten*, recognised the injurious effects due to the admission of pus into the blood. He supposed "that pus being sometimes absorbed by the eroded mouths of lymphatic or sanguineous vessels, mixing with the blood, infecting it, and becoming collected in the viscera, disturbed their functions, and thus produced numerous, and these the most serious, diseases."§

Morgagni (1740) somewhat obscurely hinted at the doctrine of the re-absorption of pus—a doctrine which was afterwards elaborated by *Quesnay* in 1819. *Morgagni*, after quoting a great number of instances of wounds of the head, followed by visceral abscesses,|| opposes the idea of a mechanical transport of pus thither—states that such abscesses are not confined to the liver—and that they may follow wounds and ulcers of other parts besides the head. He ascribes their formation to particles of pus ("not always deposited in the form of pus"), resulting from the softening and

* *Paré*, A. "Opera." Folio, 1582, lib. xvii. cap. 51.

† *Andral*. "Revue Médicale." December 1826, pp. 9, 57, *et seq.*

‡ *Valsalva*, A. M. "Epistolæ Anatomicæ," n. 15, *in sin.*

§ *Boerhaave*, H. Aphorismus, 406.

|| *Morgagni*, J. B. Translated by Dr Alexander, pp. 98–100.

suppuration of small tubercles, which having been mixed with the blood and disseminated, are arrested in some of the narrow passages, perhaps of the lymphatic glands, and by obstructing and irritating these, as happens in the production of venereal buboes, and by retaining the humours therein, distend them, and give origin to the generation of a much more copious pus than what is carried thither. "And by this means," he says, "we may also conceive how it is that much more pus is frequently found in the viscera and cavities of the bodies, than a small wound could have produced."*

Subsequently to the middle of the last century the opinion was held that matter was taken up and transferred ready formed to a new situation, causing a metastatic abscess.

Cheston (1766) remarks that "translations of matter from one part to another are by no means uncommon, but are frequently to be met with after amputations of the larger limbs, when the *vis vitæ* is impaired, and cannot support that discharge of matter, so necessary to complete the design of nature in healing a large wound; but, under such circumstances, there is very little, if any, appearance of an inflammation, and the matter is rather disseminated through the viscus on which it falls, than is collected in one or more large vomicæ."†

Berthelot (1780) mentions a case of purulent infection following diarrhœa.‡

John Hunter (1793), in this country, and after him

* Morgagni, J. B. Trans. by Dr Alexander, p. 103, b. iv. let. 51, art. 23.

† Cheston. 1766. *Vide Bibliography.*

‡ Berthelot. "Ancien Journal de Médecine," 1780, tom. liii. p. 258.

Velpeau, in France, demonstrated the existence of pus in blood. Hunter further pointed out the influence and mode of action of phlebitis. He described three forms of inflammation of the veins—viz., adhesive, suppurative, and ulcerative.*

Pyæmia he considered to be an aggravated form of phlebitis. He remarks, that “in all cases where inflammation of the veins runs high, or extends itself considerably, it is to be expected that the whole system will be affected.” He regards the ready passage of purulent matter into the common circulation to be of occasional occurrence, *e.g.*, when an abscess opened into a vein. “For the most part,” says Hunter, speaking of inflammation of the veins, “the same kind of affection takes place as that which arises from other inflammations, with this exception, that where no adhesions of the sides of the veins are formed, or, where such adhesions are incomplete, pus, passing into the circulation, may add to the general disorder, and even render it fatal.” The pus in the veins he considered to be provided by its walls. Death, he thought to result in such instances, from the extension of the inflammation to the heart, or from the matter secreted by the inside of the vein passing along that tube, in considerable quantity, to the heart, and mixing with the blood.†

Desault (1794) referred this disease (pyæmia) to nervous agency. Abscess of the liver he considered to be a very frequent sequence of head injuries.‡

* Hunter, J. “Observations on the Inflammation of the Internal Coats of Veins,” p. 18.

† *Ibid.* p. 26.

‡ Desault, in the “*Mémoires de l’Académie de Clinique*,” 1819, tom. iii. p. 456.

It is remarkable that this fact should not have been noticed by Pott, and other eminent English surgeons of this period.

Home (1810) and others, held that the blood globules became transformed into pus corpuscles.*

Richerand (1812) believed in the consentaneous injury of remote parts, and thus accounted for the frequent occurrence of hepatic abscesses after injuries of the head.†

Montezzia (1813) described carefully the pathological appearances met with after death from suppurative fever, and referred them to the absorption of pus and other diseased secretions into the blood.‡

Larrey (1812) mentions the case of General Cafarelli, who died on the nineteenth day after amputation of the arm, and in whose body, at the autopsy, were found abscesses both in the liver and in the lungs.§

Another case is given by him of a Prussian soldier, who, during the Peninsular war, sustained a compound fracture of the arm of which he died. After death, a large abscess of the liver, which had burst into the abdomen, was discovered. || Such abscesses Larrey referred to the irritation excited in the liver by sympathy with the inflammatory action which had been established in the fibrous membranes of the cranium, or of the bones of the upper or lower extremity, but chiefly those of the same side, and by the metastasis to this viscus of the “miasmes ichoreux, ou d’un fluide plus ou moins acre et subtil.” In his description of

* Home, in the Philosophical Transactions, 1810, p. 75.

† Richerand. “Mémoires de l’Académie de Clinique,” 1819.

‡ Montezzia. 1813, edizione seconda, p. 86.

§ Larrey. Tom i. p. 306 ; Paris, 1812.

|| Larrey. 1817, tom. iv. p. 229.

the campaign in Egypt in the year 1800, Larrey gives a very accurate account of the symptoms of both the acute and chronic forms of suppurative fever. He terms this "la fièvre jaune." He says that it attacked "especially those who had been wounded in the joints, or had had bones fractured, the nerves, head, abdomen, or chest injured. He considered the disease to be contagious."*

Boyer (1814) uses the expression "La suppression de la suppuration," but never employs the term pyæmia or purulent infection. He describes the following symptoms:—"Des frissons irréguliers, un pouls concentré et débile, des sueurs froides, des angoisses, des oppressions, des défaillances, quelquefois des convulsions, le délire, l'assoupissement léthargique, de l'aridité, &c." Boyer proceeds to mention the formation of internal abscesses—"Tantôt dans le foie, tantôt dans le poumon, tantôt dans le méésentère, et tantôt dans le cerveau." These abscesses, he says, are, without doubt, the cause of the death of the patient, and he considers them to be the cause of the suppression of the suppuration and of all the accidents which accompany it. He thus, in fact, regards as the cause, what we consider to be the effect.†

Hodgson (1815) suggested the connexion between the two classes of phenomena (purulent infection resulting from phlebitis), and affirms that the inflammation extends in some "instances even to the membrane which lines the cavity of the heart;" and that the symptoms resemble those of typhus. The great debility present in this disease he considers to be an effect produced upon the nervous system by the pus, which is secreted

* Larrey. 1812, "La fièvre jaune," pp. 19 *et seq.*

† Boyer. "Traité des Maladies Chirurgicales," 1814, p. 318.

into the vessels, being mixed with the circulating fluid.*

Riber (1816) pointed out the agency of phlebitis in the production of the fatal train of symptoms in puerperal women ; but he does not trace the connexion between the local and constitutional affections.†

Charles Bell (1817) observed that the lungs were most commonly affected secondarily; and that “the more general the injury was, the more prone were the lungs to sympathise.”‡ He remarks—“On reviewing this subject it will be apparent, that injuries to the frame, whether the effect of wounds or of surgical operations, by exciting a high state of irritation, tend to disorder the lungs ; and that, especially if there is any tendency to disease in this organ, however latent before the injury, it will be developed ; and, increasing the constitutional disturbance, endanger the patient’s life. It also appears, that as wounds, by their sudden and more violent inflammation, produce a corresponding acute attack upon the lungs, so do they often, by more gradual influence, bring on phthisis. How often are we inclined to say that the patient who dies after a great operation, has fallen a victim to abscess in the lungs, without duly considering how much the stimulus of the knife has to do in exciting this mischief?”§

Travers (1818) combats the idea of purulent absorption, and draws a distinction between the cases where the inflammation of the vein terminates in the forma-

* Hodgson, pp. 511–518.

† *Riber*. “Exposé Sommaire de quelques Recherches Anatomiques, Physiologiques, et Pathologiques,” in “Les Mémoires de la Société Médicale d’Emulation.” Paris, 1817, pp. 624–628.

‡ Chas. Bell. 1817, pp. 241 and 252.

§ *Ibid.* p. 257.

tion of pus, and where it terminates in the deposit of adhesive matter or lymph ; the latter extending to the trunks of the system ; and, sometimes, it is said, reaching the heart. The former he describes as a protracted irritative state, the latter as a typhoid condition which terminates within a few days. The former cases, though always dangerous, sometimes recover ; the latter, never. "If we consider," says Travers, "the importance of the veins in the economy, the extent of surface which the collective area of the venous trunks afford, and the diffused and disorganising character of the inflammation, we can surely be at no loss to account for the disturbance of the system. All the mystery of the veins is that they are indisposed to inflame, but when excited, inflame by continuity, and therefore it is that the constitution sympathises so deeply."* The symptoms are due to an affection of the *nervous system*. Travers considers that cases in which small operations have proved fatal in a week or ten days are quite inexplicable, except on the presumption of a pre-existing morbid diathesis, or an actual morbid change.†

The nervous theory was held also by Barthez, Brodie, W. Philips, and Copland ; but while the last-named writers considered that the ganglionic system was the part affected, the first two traced the symptoms of pyæmia to disease of the cerebrospinal nervous system.

R. Carmichael (1818) ascribed the constitutional affection to pus mixing with the mass of the blood.‡

Quesnay (1819) combined the doctrine of Boerhaave

* Travers. 1818, p. 286.

† *Ibid.* "A further Inquiry concerning Constitutional Irritation and the Pathology of the Nervous System," 1835, p. 13.

‡ Carmichael, R. 1818, p. 368.

with that of Morgagni—referring the origin of secondary abscesses to the absorption and diffusion of pus through the blood, and to the excitation of inflammation by it in distant organs.* He also mentions a case of abscess of the liver following fracture of one of the parietal bones.†

Bertrandi and Andouillé (1819) sought for a mechanical explanation of the occurrence of hepatic abscesses after head injuries, and in cases of apoplexy. “The blood,” they say, “circulates more slowly in the liver, because that which returns by the superior vena cava presents more resistance, from its too much precipitancy and its too great bulk, to that which is conveyed by the inferior vena cava.” During vomiting, which is one of the chief symptoms in such cases, the liver is compressed by the action of the diaphragm, stomach, and intestines, the movement of the blood in the portal vein is accelerated, and, if it cannot overcome this resistance, engorgement will take place in a short time. The secretion of bile will be interrupted; this humour, retained in the blood, and altering the constitution of that fluid, will not a little contribute to the increase of the symptoms; fever will be kindled; the deposit will very quickly be affected, and this deposit will end in suppuration or putrefaction. “There is enough here,” says *Bertrandi*, “to produce a stasis, which will give place to an inflammation which may terminate in gangrene or suppuration—the second termination being the most usual.”‡

* Quesnay. “Remarques sur les Plaies de Cerveau, in the *Mémoires de l’Académie Royale de Chirurgie*.” Paris, 1819, tom. i. p. 330.

† *Ibid.* p. 147.

‡ *Bertrandi and Andouillé*. 1819, tom. iii. p. 484.

Breschet (1819) remarks, that in several subjects who had died of typhus, he had found evident traces of inflammation of the veins within the cranium, and he considered typhus as a series of symptoms dependent on inflammation of the veins.*

Gendrin (1820) states that the blood globules are converted into pus corpuscles. He founded this remark on the observation that, by mixing pus and blood in the proportion of one to eight, after twenty-four hours none but pus corpuscles can be detected.†

James (1821) says :—"If the position above adduced be true, viz., that the constitutional affection varies in nature according to the local inflammation, then, as there are many and very different kinds of inflammation, there will be numerous modifications of the systemic affection called fever. With regard to the circulation of pus in veins, on which so much stress has been laid, it appears to me very far from being proved. In those cases where pus has been found in the veins, a barrier of some kind or other has been noticed between it and the blood, and an appearance of blood has been observed mixed with the pus; whence we may infer, that no pus had mixed with the blood. In truth, the circulation does not continue through veins containing pus. It is possible that matter may be secreted from their linings beyond the adhesions, and be washed away immediately; but this must be conjecture."‡

Velpeau (1823 and 1826) put forward various untenable hypotheses of the metastasis or transport of

* *Breschet*. 1819. *Vide Bibliography*.

† *Gendrin*. 1820, pp. 13, 14.

‡ *James*. 1821, pp. 51 and 216.

pus, and the conversion of the metastatic abscesses into schirrhous or tubercular masses. Secondary abscesses in the liver and lungs he held to be indistinguishable from tubercular and schirrhous masses. He believed in the absorption directly by the veins, but did not refer to the connexion between phlebitis and the formation of secondary abscesses. Velpeau termed this disease "*Pleurisie purulente des Opérés.*" "I believe," he says, "that altered fluids play here the principal part, that matters reach these centres by a true metastasis, that they are absorbed from points of primitive suppuration, that the inflammation,—when it is developed,—is only secondary; that it is excited by a superfluous particle of this heterogeneous fluid introduced into the circulation, which forms a centre in the midst of those parts; that at least this is a *phlegmasia sui generis* differing essentially from a free inflammation in its course and in its character."*

Guthrie (1827) described two forms of inflammation of the veins, viz., the adhesive or healthy, and the irritative, erysipelatous, or unhealthy. He laid great stress on constitutional predisposition to disease in certain organs leading to the formation of secondary abscesses in those viscera. The origin of the secondary abscesses he considered to be "an alteration which takes place in the sanguiferous system, in consequence of the amputation; and the suppression of the discharge, causing fever, and a determination to, and irritation in, a particular part."†

Sir A. Cooper (1827) believed that death was caused by an extension of the inflammation to the heart, and

* Velpeau. "*Leçons Orales de Clinique Chirurgicale,*" 1841, p. 14.

† Guthrie. 1827, 3d edition, p. 229.

that the constitutional symptoms were due to pus in the veins.*

Rose (1828) attributed the symptoms to a disturbance of the nervous system. He says:—"They are to be classed amongst the effects of constitutional irritation arising from local injury, and are certainly striking illustrations of the irregular action of the vascular system to which that irritation may give rise."† He met with secondary abscesses in the lungs, liver, and spleen, after various accidents and operations. No difference in the patient's constitution, or in the mode of treatment, affected the result in such cases. "In all cases which I have seen," he remarks, "these abscesses took place at some period between the end of the second and that of the fifth week after the accident which gave rise to them."

Maréchal (1828), writing at the same time as *Dance*, furnishes a most accurate account of the process of formation of metastatic abscesses due, according to his views, to absorption of pus by the open veins.

Dance (1828) described three orders of symptoms in phlebitis:—The first, local, without fever; the second, with more or less of general symptoms superadded to the local, and caused by the extension and intensity of the inflammation; and a third, characterised by shiverings, prostration, great alteration of expression, delirium, soft pulse, difficult respiration, &c., induced by the passage of pus into the blood, and the various complications to which it gives rise. He thought that the blood, being rendered more fluid and being altered by pus, always produced, in the first instance, a little ecchy-

* Cooper, Sir Astley. 1827, pp. 205–208.

† Rose. 1828, vol. xiv. p. 263.

mosis, and soon after a true inflammation, before determining an abscess.*

By the researches of Dance a great impulse was given, and the relation of phlebitis to purulent infection, as cause and effect, was considered to be no longer hypothetical, but demonstrated; and to such an extent was this the case, that the formation of secondary abscesses began to be attributed not to the agency of pus, but to that of capillary phlebitis.

Arnott (1829) concluded from his observations:—*1st*, That death does not result from the extension of the inflammation of the veins to the heart; *2d*, That the dangerous consequences of phlebitis have no direct relation to the extent of the vein which is inflamed; and, *3d*, That the presence of pus in the veins, though the principal, is not the sole cause of the secondary affection.† He, accordingly, opposes the idea of *Abernethy*, *Carmichael*, &c., that the constitutional affection is owing to the extension of the inflammation to the heart. The publication of *Arnott's* and *Dance's* treatises led to the general opinion being held in England and in France, that phlebitis and purulent infection were identical affections; or, at least, that the latter was invariably caused by the former.

Legallois (1829)‡ confirmed *Dance's* experiments, and believed that pus injected into the veins coagulated the blood and did not mix with the circulating fluid.

Cruveilhier (1829), admitting the doctrine of the formation of secondary abscesses being due to capillary phlebitis, further laid down an axiom, since proved

* *Dance*. 1828, vol. xviii. p. 288.

† *Arnott*. 1829. *Vide Bibliography*.

‡ *Legallois*. 1829. *Vide Bibliography*.

untenable, "that any foreign body introduced into the veins, whose elimination by the emunctories is impossible, will produce visceral abscesses similar to those which occur after wounds and operations, and that these abscesses are the result of capillary phlebitis of those viscera."* He concluded, from his experiments, that pus caused coagulation in the blood-vessels; and he supposed that pus did not find its way into the centre of the clot, but was secreted by the wall of the vein. He ascribed secondary abscesses to the reception of foreign substances unchanged into the circulation, and not to true absorption. He supposed phlebitis to be the necessary consequence of the introduction of pus or of any foreign body into the veins. Dance, Cruveilhier, and Blandin, believed in the doctrine of purulent infection.

Abernethy (1830) says, "that where inflammation of the venous tube is extensive, it is probable that much sympathetic fever will ensue, not merely from the excitement which inflammation usually produces, but also because irritation will be continued along the membranous lining of the vein to the heart."†

Piorry (1831) admitted the presence of pus in the blood, and described the appearance of this latter fluid in a pyæmic patient.‡ He considered that the blood itself was subject to inflammation; and in accordance with this theory he termed this disease (in 1828) *Pyohémie*. §

* Cruveilhier; reviewed in "The British and Foreign Medico-Chirurgical Review," vol. ii. p. 386.

† Abernethy. 1830, p. 150.

‡ Piorry. "Altérations du Sang." *Pyoméénie*, p. 19.

§ Piorry. "Dissertation sur cette question."—"Quelle Part a l'Inflammation dans la production des Maladies dites organiques," 1828, vol. ii. para. 835.

Von Gama (1835) considered that hepatic abscesses after head injuries were due to the effect of a common violence.*

Carswell (1836) repudiated the idea of phlebitis being necessary ; but he considered that pus circulated in and poisoned the whole system.

Liston (1837) thought the constitutional complication of suppurative phlebitis might arise from the entrance of pus into the circulation through an opening in a vein.†

Tessier (1838), who long defended the ancient doctrine of a purulent diathesis, endeavoured to show that even in suppurative phlebitis, pus never mingled with the blood. He held the idea that pyæmia was an independent blood disease, unconnected with the inflammation of the vein. He says that “at all stages of venous inflammation, the pus is enclosed in the cavity of the vein by clots or false membranes, and at no period of the anatomico-pathological existence of phlebitis is its entrance into the blood possible.”‡

Dupuytren (1839) for many years held the same opinion as Boyer ; but, writing before his death, he says :—“Visceral abscesses are produced by a true absorption of pus from wounds, and by its deposit in the organs.”§

Bérard (1842) held the phlebitic doctrine ; but

* *Von Gama*. 1835, p. 348.

† *Liston*. 1837, p. 189.

‡ *Tessier*. 1838. *Vide Bibliography*.

§ *Dupuytren*. “Des abcès viscéraux et des suppurations éloignées considérées comme complications des blessures par armes de guerre,” in his “*Leçons Orales de Clinique Chirurgicale*,” 1839, p. 104.

observed that post-mortem evidence of this lesion was sometimes wanting.*

Darcet (1842) considered that the secondary purulent deposits were sometimes absorbed and excreted by the kidneys, rendering the urine during that time albuminous.

Finger (1847) suggested that materials, harmless to those organs and textures to which they have been applied, when unused or unremoved from the blood, act as local irritants to other structures, and so engender secondary mischief, such as effusion of puriform fluid into joints. These materials may have affinity with chemical substances, but they do not admit of recognition by means of physical agents.†

Castelnau and *Ducrest* (1848), after making a series of experiments, in which they imitated nature for the first time by injecting pus repeatedly, and not once only, came to the conclusion that multiple abscesses were due to a changed condition of the blood. They were the earliest observers who proved that pus is the *only* substance competent to determine abscesses having every feature in common with those termed surgical. They also observed that the seat of abscesses produced by the injection of other fluids than of pus, is almost always in the lungs alone; but that there is no single symptom induced by purulent inoculation which may not also be caused by the injection of other substances.‡

Sédillot (1849), in his elaborate and interesting treatise on this subject, laid down the proposition

* Bérard. 1842. *Vide Bibliography.*

† Finger. 1847. *Vide Bibliography.*

‡ Castelnau and Ducrest. Reviewed in the "British and Foreign Medico-Chirurgical Review," October 1848, p. 382.

absolutely, that the symptoms described under the names purulent infection, purulent absorption, purulent diathesis, suppurative phlebitis, &c., are always produced by the admission of the pus globule into the blood ; and he, further, confirmed Castelnau and Dugrest's observation as to the necessity, in the case of animals, of repeated injections, for the course of the symptoms depends on the persistence of the source of the pus. He says, " there are two distinct diseases, though connected by some appearances in common. The one is determined by the solid elements of the pus, the other by the putridity of some animalised substance." Sédillot considered that pus admitted into the blood exerted no direct action on that fluid whatever, and only became mischievous when it was detained in the capillary vessels of the lungs or other organs, exciting the irritative symptoms characteristic of the affection, in consequence of the impediment it offered to the due performance of their functions, and to the attempts made at its elimination. He distinguishes pus from white blood corpuscles thus : the latter are one-sixth or one-fifth smaller, lenticular, not spherical, smoother on their surface, and the nuclei of the latter are very small. When both are present, the white corpuscles are less numerous than the others. Pus, he says, may be introduced into the circulation in various ways, and may be derived from a wound, an ulcer, an abscess, or a phlebitis. Aware that the veins leading from a wound, supposed to be the source of purulent infection, are often found, on the most careful examination after death, to be closed, and filled with firm fibrinous clots, Sédillot overcomes this obstacle to his theory by saying, that erosions too small to be recognisable may never-

theless exist in such vessels. While Lebert and Sédillot held that white blood corpuscles can be distinguished from pus corpuscles, Henlé, Donné, and Virchow assert they cannot. Sédillot concludes from his experiments —“ 1st, That pus when injected into the veins in sufficient quantity always determines metastatic abscesses and death, and, in minor quantity, is usually followed by recovery. 2d, That no other animal substance produces symptoms of purulent infection. 3d, That the globules alone, and not the serosity, are concerned in these effects.”*

Henry Lee (1850) draws the following conclusions from the facts which he had collected, experimentally and otherwise: viz., Firstly, that inflammation of a vein or phlebitis is no essential part of the primary affection which precedes constitutional symptoms, even when morbid matter had found its way into the circulation through a vein. Secondly, that when inflammation of a vein does occur, in some instances at least, it is not the cause, but the consequence of the introduction of diseased or foreign matter into the blood. Thirdly, that although veins are with difficulty inflamed by any mechanical injury, they are susceptible of rapid inflammation, accompanied with constitutional disorder, whenever any irritating fluids are introduced into their cavities. Lee thinks that before purulent infection of the system can occur, the blood must have been so vitiated as to impair its power of coagulation.†

Solly (1851) considers “that the prevalence of pyæmia

* Sédillot. “De l’Infection Purulente, ou Pyæmie,” 1849. Reviewed in the “British and Foreign Medico-Chirurgical Review,” October 1849, pp. 349–360.

† Lee, Henry. 1850, pp. 45 *et seq.*

at the present time is dependent on some occult atmospheric causes over which we have no control," and that the secondary suppurations are owing to purulent absorption. "I am quite sure," he says, "that mental anxiety has carried more poor fellows to the grave than any single cause that the surgeon has to contend with. I have also observed purulent absorption more frequently in patients, who, to use their own phrase, 'have had something on their minds.'" Pus is absorbed, he thinks, both by the veins and by the lymphatics; and "when pus is absorbed by the veins, they are not usually enlarged."*

Wood (1858) states, that "metastatic abscess," "purulent infection," or "pyæmic fever," when traceable to a local point of injury or inflammation, is "produced apparently by altered pus, or other sanious product of inflammation, being absorbed into the veins, and setting on foot a zymotic change in the blood, especially, it is probable, in the fibrine;" while, when no wound or purulent centre is present, the systemic infection is due to "causes acting through the digestive organs and the nervous system."† The poison, according to him, is probably a sanious fluid, arising from decomposition of the pus.

Chevers (1859) lays great stress on previous abdominal complications as predisposing to pyæmia.‡

Röser (1860) regards pyæmia as presenting a primary form, dependent on the introduction of a specific poison

* Solly, S. "On Purulent Absorption," in the "Lancet," March 15, 1851, p. 289.

† Wood, G. B. 1858, vol. ii. p. 254.

‡ Chevers, in the "Medical Times and Gazette," 1859, vol. i. p. 94.

into the system, like that of scarlatina; and also a secondary form, in which the system becomes infected by a poison, formed in some individual organ of the patient's own body.

Sir J. Y. Simpson (1860) objects to the term *Pyæmia*, and prefers the name "Surgical Fever." This state of the surgical patient he considers to be generically, if not specifically, the same as puerperal fever in the child-bed mother. He further proves the analogy between these two diseases as regards their anatomical conditions, pathological lesions, symptoms, and progress. Neither of them, he says, can be excited artificially by the common causes of inflammation, "but they are developed by specific causes," and allied to them both is erysipelas. Both he ascribes to a vitiated or diseased condition of the general circulating fluid. "This doctrine," he remarks, "enables us to perceive, how in one set of cases, or one epidemic of puerperal fever, the febrile effect or element may be more marked than the inflammatory; and how, in others, and these generally the most amenable to treatment, the inflammatory effect or element may be more marked or more prominent than the febrile."*

Callander (1860) remarks, that "an animal or septic poison, introduced into the system, is the exciting cause of the primary disease, systemic infection. It is connected in some subtle manner with a vitiated condition of the blood. The blood undergoes decomposition, or, as some please to have it, passes into a state of fermentation, but withal does not present any appreciable change." He divides the disease into septic infection

* *Simpson, Sir J. Y. 1860, vol. ii. pp. i. et seq.*

and pyæmia. "It is now known," says he, "that the lining membrane of veins rarely presents evidences of inflammation; that it probably never secretes pus, and that the appearance of suppuration noticed in these vessels is, in truth, caused by softening clots."*

Virchow (1860), examining the subject from a pathological point of view, affirms that it is a puriform, but not a purulent substance "which infects the system and produces this disease." Every time, he says, metastatic deposits occur, thrombosis is also present in certain vessels. "In using the term 'Pyæmia,' we must not seek," he remarks, "for a common central point in a purulent infection of the blood," but the term must be regarded as a collective name for several processes dissimilar in their nature. The constitutional symptoms may, according to this distinguished pathologist, be due to three sets of causes: thrombosis, resulting in mechanical obstruction, caused by the arrestment of a fragment of foreign matter in the capillaries; ichorous infection (*septhæmia*), "a dyscrasia, in which ichorous substance has made its way into the body, displaying its effects in an acute form in the organs which have a special predilection for such matters," and leucocytosis, when there is irritation of the lymphatic glands. He considers, that while in *dyscrasiæ*, as *scrofula*, *cancer*, &c., the constitution is secondarily affected after the organs, the opposite condition occurs in *pyæmia*.†

The various writers on this subject since the last-mentioned date have discussed chiefly the relation of

* Callander, J. W., in "Holme's Surgery," vol. i. p. 266.

† Virchow, R. "Cellular Pathology." Translated by Dr Chance, 1860, pp. 177-220.

phlebitis and of thrombosis to pyæmia. They, finding that these complications are nearly as often absent as they are present in patients suffering from the marked constitutional symptoms of pyæmia, consider that these two morbid conditions, besides serving as exciting causes of systemic infection, cannot be looked upon as the only sources of suppurative fever.

Wilks (1861) considers that pus, or its elements or germs, give rise to purulent deposits, as cancer-germs give rise to cancerous growths at a distance. The channel of infection is probably a small vein which absorbs the morbid matter, and this latter matter causes coagulation of the blood with congestion terminating in suppuration or sloughing.*

Erichsen (1864), in examining the bodies of a considerable number of patients who had died of pyæmia, "often found evidence of other diffuse inflammations as well as of phlebitis, and in some cases no inflammation of the veins could be detected on the most careful investigation specially directed to this point;" and hence he came to the conclusion "that pyæmia, though frequently co-existing with suppurative phlebitis, may occur independently of it, and cannot, therefore, in all cases, be necessarily considered a consequence of that disease."†

Fayrer, of Calcutta (1865), from his observations, concludes that osteomyelitis—"an acute and diffuse inflammation, a sort of erysipelatous form"—is a very frequent source of pyæmia.‡

Allen (1865), on the other hand, regards the exact

* *Wilks*, in the "Guy's Hospital Reports," vii. 1861.

† *Erichsen's Surgery*. 1864, pp. 461-467.

‡ *Fayrer*, Prof. "Indian Annals of Medical Science," October 1865.

relation existing between pyæmia and osteomyelitis as uncertain.*

Savory (1866) considers the name pyæmia to be an unfortunate one, and holds that the distinction between ichoræmia or septicæmia and pyæmia cannot be established. He thinks that the disease may be not only chronic, but also transient and recurrent. He says gonorrhœal rheumatism is allied to pyæmia. The causes of the local congestions and suppurations in pyæmia he classifies thus:—

“Stasis due to mechanical action: a blockade produced by the impaction of solid particles according to their size.

“Arterial embolism: by fragments too large to pass through the smaller arteries.

“Capillary embolism: by fragments small enough to pass into the capillaries.

“Stasis due to change in the blood produced by the admixture of morbid fluids: the local effect of blood poisoning properly so-called, capillary obstruction.

“Stasis due to a combination of the two above-mentioned causes. The subsequent changes are determined by the action of the morbid fluid or obstructing substance—the changes it provokes—and by the constitution and health of the individual.”

“While,” he says, “cases of simple embolism must be referred to the action of solid particles, the terrible disease known as pyæmia must be due to the action of some putrid fluid poisoning the blood.” “The effects of the subtle poison,” he says, “are, moreover, proportionate to the intensity of the poison—

* Allen. 1865, p. 30.

the quantity introduced—and the rate of its absorption.”*

Baker (1866), in his “Reply to the British Medical Association,” after reviewing briefly the history of pyæmia, and succinctly detailing the various theories and facts hitherto disclosed on this matter, remarks that there is ample ground in the statements which have been made, for the suspicion that the entrance of pus into the blood of human beings is one of the causes of pyæmia. “At present,” he says, “we cannot estimate the frequency of this cause, nor can we determine dogmatically the modes in which pus gains entrance to the blood, or the process, zymotic or otherwise, by which it induces the symptoms and pathological changes which attend that disorder.” The next source of pyæmia discussed by Baker is that of embolism, so strongly insisted on by Virchow. Embolia may be derived from disintegrating clots, or, according to the experiments of Liston and Mackenzie, from irritation of the lining membrane of veins, produced artificially by these observers on injecting solutions of lactic acid and of oxide of zinc. “It follows from what I have stated,” remarks Baker, “that pyæmia may result from phlebitis of a suppurative kind, although such a source of blood-disorder is believed to be of infrequent occurrence; and that the same effects may be produced by embolism in the minute ultimate arteries, from chronic disease invading arteries of larger size. In the introduction of foreign matters,

* Savory, W. “St Bartholomew’s Hospital Reports, 1866.” Reviewed in the “Biennial Retrospect of Medicine and Surgery by the New Sydenham Society,” 1867; and in Braithwaite’s “Retrospect of Medicine,” January to June 1867.

whether hurtful or otherwise, into the blood, the capillaries have by far the most active powers of the whole system of blood-vessels.”*

Bristowe (1866) says, “We do not see how the embolia theory explains satisfactorily those cases of pyæmia, starting from some portion of the systemic nervous system, in which the lungs escape in great measure or entirely, while secondary deposits are found, it may be, abundantly, in other organs. Lastly, it seems to us as erroneous to regard the corpuscular elements of pus only as pus, as it would be to attach that name to the ‘liquor puris’ exclusively. On the whole, we are disposed to believe, that, owing to some form of unhealthy process supervening in the region of primary disease, unhealthy pus, or the elements of unhealthy pus (call it ichor if you will), find their way into the circulating fluid, and poison it; that this poison partly shows itself in producing in the blood a tendency to coagulate in the smaller vessels, partly shows itself in inducing more subtle but even more serious effects upon the system at large. We are not disposed to deny that some of the local effects may really be due to embolism, some even to the impaction of coagulated masses of pus cells; but we believe that thrombosis alone is the more general explanation of that obstruction of the minute vessels which leads to the secondary deposits.”†

Summary.—From the preceding extracts, it will be observed that the disease pyæmia, or suppurative fever,

* Baker, A. Birmingham, 1866, pp. 15, 16, and 10, 11.

† Bristowe, J. D., in Reynold’s “System of Medicine,” 1866, vol. i. p. 207.

has been recognised in a more or less perfect manner since the days of Hippocrates.

Aretæus refers to it under the title *Peripneumonia*, and he looked on the secondary abscesses as the results of metastasis.

In the middle of the sixteenth century we observe this disease mentioned as a consequence of head injuries, and of surgical wounds ; and we find Ambrose Paré ascribing the pathological changes to much the same cause as do modern surgeons, viz., to an altered condition of the fluids of the body. After this there is a gap in the bibliography of suppurative fever, which extends over nearly two centuries.

Thus we come to the days of Boerhaave, who for the first time expressed a belief in the possible admixture of pus with the circulating fluid, and hinted at a purulent origin of pyæmia. This doctrine of the absorption of pus we find supported a few years later by Morgagni, who relates several cases of purulent infection ; and six years after him, by Cheston, whose theory of metastasis has not received much support.

That famous physiologist and keen observer, John Hunter, endeavoured to establish an invariable connection between phlebitis and suppurative fever, as one of cause and effect. Ten years later Desault, not satisfied with the explanations given by his predecessors, ascribed this disease to nervous agency. Boyer's theory of "suppression of the suppuration," as resulting from the formation of secondary abscesses ; Hodgson's and Riber's of the phlebotic origin of pyæmia ; Charles Bell's supposition of hereditary predisposition affecting the seat of the secondary lesions ; Travers' of

“constitutional irritation ;” and Bertrandi’s of a stasis in the liver consequent on increased bulk, and rapidity of the blood in the superior vena cava retarding the current in the inferior vena cava ;—each and all flourished for a time, and then fell into oblivion.

Dupuytren, Quesnay, Ledran, Maréchal, and others, ascribed the development of visceral abscesses to the absorption into and circulation of pus with the blood, and to the excitation thereby of inflammation in the internal organs. That pyæmia is induced by phlebitis, was held by Dance, Arnott, Cruveilhier, Blandin, Bérard, &c. Borden attributed the transport of pus to the communication which exists between all parts of the cellular tissue.

In Velpeau’s celebrated and highly instructive memoir on this subject, the solution given of the problem is a combination of Ambrose Paré’s theory—of altered fluids being the cause of the disease—with that of Cheston—the metastatic origin of visceral abscesses. This distinguished physician further pointed out that a certain relation subsisted between the purulent visceral deposits and the constitutional symptoms, as between effect and cause.

Guthrie we find ascribing suppurative fever to an alteration in the blood, produced by the wound, and to a suppression of the discharge, causing systemic infection. The pathological lesions met with in this disease were very fully, and pretty accurately, described by Velpeau, and subsequently by Rose, who referred the symptoms to nervous agency.

To Arnott and Dance are due the credit of referring the formation of the visceral abscesses to capillary phlebitis, and of attempting to prove a most intimate

relationship between suppurative phlebitis and purulent infection. Cruveilhier published, in the following year, an account of his numerous and highly interesting experiments on the introduction of various foreign substances into the blood. He came to the conclusion, that the symptoms and the pathological lesions which are met with in pyæmia are producible by the admixture with the circulating fluid of very various foreign matters, and that the visceral lesions are due more immediately to capillary phlebitis.

The name pyæmia (*pyohæmia*, *pyohémie*) was given two years later by Piorry to this disease.

The authors who next treat of this subject, we find either believing in the phlebitic origin of suppurative fever, or opposing this doctrine without furnishing another in its place.

Thus the matter remained during about twenty years, when Castelnau and Ducrest, following Cruveilhier's example, made a large series of experiments, by injecting foreign substances into the veins of dogs. From data thus obtained, these writers arrived at the most important conclusion, viz., that pus is the only substance capable of determining abscesses, having every feature in common with those termed surgical.

Sédillot inferred, from the experiments he made about the same time as the last-mentioned physiologists, that two separate diseases were induced by the admission of pus into the blood,—the one traceable to the corpuscular, the other to the liquid portion of the purulent fluid.

Henry Lee, who published a monograph in the following year on inflammation of the veins, remarks that phlebitis does not necessarily precede pyæmia, and that

the coagulability of the blood is impaired before morbid matter can find its way into the circulation.

Within the last quarter of a century, we find the phlebitic origin of suppurative fever, formerly so strongly advocated by Liston, Cooper, &c., and more recently by G. Budd, Wilks, Holmes, and others, altogether discarded, and research directed to the detection of some *materies morbi* in the blood. Wood supposes this alteration in the blood to be of a zymotic nature. Professor Polli of Milan, likewise, ascribed to this morbid process a fermentative character. While Callander speaks of suppurative fever as possessing a double nature, that of septic infection and of pyæmia, Virchow ascribes this condition to three classes of causes—to thrombosis, to ichorous infection, and to leucocytosis. Of late, the origin of suppurative fever from osteomyelitis has been promulgated by Professor Fayrer of Calcutta; but in support of this theory a very small amount of evidence is producible. Savory, in an elaborate essay published recently on this subject, and which is based on clinical observation, considers that the local phenomena of secondary abscesses in the viscera may be ascribed to embolism, while the constitutional symptoms are owing to some occult toxæmic agency in the blood. Bristowe regards phlebitis as a frequent cause of pyæmia, and thrombosis as the first step in the formation of visceral abscesses. Hence, we find that the most recent writers on this subject, while endeavouring to discover some special cause of suppurative fever, and while rejecting the theory of an invariable relation between phlebitis and pyæmia, as between cause and effect, nevertheless

refer the purulent visceral deposits to capillary phlebitis, or its result embolism.

In addition to the elaborate essays we have specified in this summary, numerous references to various works which contain isolated and interesting examples of this disease, are given in the preceding historical notice of suppurative fever.

CHAPTER II.

DEFINITION OF PYÆMIA, OR SUPPURATIVE FEVER.

PYÆMIA may be defined to be a fever, which, attacking persons of all ages, is generally sequent on wounds, acute inflammation of bone, the puerperal state, surgical operations, or other sources of purulent formation and septic infection. It appears sometimes to prevail in an epidemic form. No one cause has as yet been found to produce this disease. The presence of pus is not necessary for its occurrence. The injection of putrid fluids, as also of chyme, and other healthy fluids, induces in animals symptoms like those of suppurative fever, and pathological appearances in the viscera similar to those met with in the early stages of this disease. The symptoms most pathognomonic of suppurative fever are, a more or less sudden invasion on the fourth or fifth day after an operation, marked generally by rigors, or by depression of spirits and great anxiety, followed by profuse perspirations; the pulse is generally rapid; the tongue is furred, then loaded, and by-and-by brown and dry; the skin assumes a dusky, sallow, and then a somewhat icteric tinge; there is very great prostration and emaciation; one or more of the joints swell, become red and painful, and may even suppurate; the breath has a heavy, sweetish,

or purulent odour; and there is laboured respiration, delirium, or other symptoms indicative of certain organs being chiefly involved. This fever has no fixed duration, but it exhibits certain stages, and generally abates or becomes intensified on the seventh, eighth, fifteenth, twenty-first, twenty-second, or twenty-eighth days, dating from the first rigor or other initiatory symptom. It is characterised by the formation of secondary abscesses in internal organs (most frequently in the lungs, the liver, kidneys, spleen, and brain), and also in the joints and cellular tissue.

I have designated pyæmia a fever, because it seems to me, that, regarding its origin, symptoms, progress, and pathology, this disease is more nearly allied to the class of febrile affections than to any other group of diseases with which we are acquainted. This view is further confirmed by the only treatment which has, as yet, been followed by success. A liberal and properly regulated use of stimulants, and of nourishing diet, has alone been found efficacious in averting that serious issue which has hitherto compelled surgeons to view a rigor after an operation as a death signal.

NOMENCLATURE.

This disease has been variously named according to the supposed source of its active principle, or essential cause.

Phlebitis.—From the days of Hippocrates, even to our time, this disease has been connected by writers with inflammation of the veins; and the term phlebitis

remains in medical lore as synonymous (according to some) with pyæmia. Hunter (1793) used this term. Riber (1816) referred the fatal symptoms to this complication. Carmichael (1818), Breschet (1819), and Abernethy (1830), also held this view. Guthrie (1827), Sir A. Cooper (1827), Bouillard (1825), Dance (1828), Cruveilhier (1829), ascribed the formation of secondary abscesses to capillary phlebitis. Cruveilhier, Dance, and Arnott (1829), regarded phlebitis and purulent infection as identical affections. Liston (1837), Teissier (1838), Samuel Cooper (1826), Syme (1848), Hyde Salter, Bransby Cooper (1833), Vidal, Nelaton, Bérard (1842), Lee (1850), all used this term.

Purulent Diathesis.—This name was first given by Ambrose Paré (1582), and the disease thereby signified was ascribed to atmospheric influences. Boerhaave (1737) considered this condition to be excited by the absorption of pus through veins. This pus Morgagni (1740) traced to broken down tubercles, the particles of which becoming arrested in the capillaries acted as local irritants. The theory of the absorption of pus and other diseased secretions, was first held by De Haen (1761). Teissier (1838) strongly defended this doctrine. Legallois (1829) and Billroth (1862) used this term.

Metastasis.—Cheston (1766) advocated the metastatic origin of this disease. He speaks of translations of matter from one part to another being frequently met with after amputations. Aretæus (in the second century) held this view also.

Purulent Infection.—Berthelot (1780) employed this expression, as also did Hodgson (1815), and

Velpeau (1826). Sédillot (1849) entitled his treatise, "De l'Infection Purulente, ou Pyæmie." Wood (1858) mentions it among his other synonyms for this disease. Toynbee (1860) uses this appellation. Panum (1863) terms it putrid or septic infection.

La fièvre jaune was the term applied by Larrey (1812) to this disease.

Constitutional irritation was proposed as a name first by Travers (1818), who considered the cerebrospinal system to be principally affected. Barthez (1843), Brodie, W. Philip, and Copland (1858), held that the ganglionic nerves formed the chief seat of irritation. This doctrine received support also from Rose (1828) and Desault (1794).

Pleurisie purulente des opérés was the appellation given by Velpeau (1826) to this disease, on account of the very frequent occurrence of pulmonary lesions after surgical operations.

Multiple abscesses.—The occurrence of such abscesses, especially in the liver, was mentioned by Larrey (1812), Bertrandi and Andouillé (1819), Pott, &c.; but this name was most strongly insisted on by Castelnau and Ducrest (1846), who considered it to be the most correct term which could be employed. Visceral abscesses were ascribed by these authors to an altered condition of the blood, and they preferred the term "multiple" to the older one of "metastatic" abscess.

Purulent absorption was the expression employed by Solly (1851), and he believed this process was performed by both veins and lymphatics. The doctrine of the admixture of purulent fluid with the blood in the system was held also by Home (1810), Montezzia (1813), Carmichael (1818), Quesnay (1819).

Gendrin (1820), Maréchal (1828), Dumas (1830), Carswell (1836), and Dupuytren (1839).

Pyæmia.—This name (pyohémie) was first proposed by Piorry (1828), and continues to be, in the present day, the current designation of the disease. We find this term employed by Sédillot (1849), Miller (1853), Gamgee (1853), Druitt (1859), Chevers (1859), Callander (1860), Röser (1860), Anderson of Glasgow (1861), Murchison (1862), Erichsen (1864), Fayrer (1865), Paget (1865), Savory (1866), Baker (1866), Bristowe (1866).

Surgical fever, in contradistinction to puerperal fever, is employed by Sir J. Y. Simpson (1860).

Thrombosis and Septhæmia are the designations used by Virchow (1860), while Sir W. Jenner terms the disease *Pyogenic fever*.

La suppression de la suppuration was the name given by Boyer (1814).

CHAPTER III.

A NARRATION OF CASES.

CASE I.—T. B., a weaver, aged 46, was admitted into hospital on June 7, with Retention of Urine. The patient stated that, during a few weeks prior to admission, he had passed his urine in a small stream, or in drops, but that he had experienced more or less difficulty during the last ten years. Complete stoppage occurred eight hours ago, and was accompanied by pain in the abdomen, and by an urgent desire to empty his bladder.

On admission, the attempt to introduce a catheter of small size was unsuccessful. After the use of a hip bath, and the application of leeches to the perineum, the patient voided his urine spontaneously. Two days later, when under the influence of chloroform, a No. 3 catheter was passed into the bladder, twenty ounces of fluid removed, and the catheter retained.

No uneasy symptoms followed the retention all night in the bladder of the catheter; but on the third day after admission, the patient complained of difficulty in breathing, and of an oppression in the chest. No pulmonary affection was detected on physical examination.

Next day (June 11), after passing a restless night, his pulse was 110. Increased temperature of the skin

and other febrile symptoms showed themselves, for which a diaphoretic mixture was ordered. The tongue was furred, and he complained of slight dyspnœa, but had no cough.

The same febrile state was present on the following day (12th June), and was accompanied by a slight cough and the expectoration of rusty sputum. His pulse was 110, and feeble, and his skin abnormally hot. On auscultation, crepitant râles were heard over the base of the left lung; and percussion over the same part elicited comparative dulness. During the evening hæmoptysis (to the amount of a pint of fluid blood) occurred, and was arrested by gallic acid. After the hæmorrhage ceased, the patient slept soundly for three hours.

June 13.—No difficulty in micturition was experienced, but the constitutional symptoms were aggravated. He slept badly. Respiration was frequent and laboured, and the sputum was tinged with blood. His countenance was anxious. His tongue was furred and dry, and he had no appetite for food. Six ounces of wine daily were ordered.

Next day (June 14) the patient was very restless. Sordes covered his teeth. His tongue was coated with a thick black crust. His pulse was very feeble, and collapse had fairly set in.

Death occurred two days later, June 16.

Pathological Appearances.—The left pleural cavity contained about ten ounces of an opaque and rather muddy fluid. Recent lymph covered the lower half of the costal and pulmonary pleuræ on the left side. The posterior half of the lower lobe of the left lung was quite solid from extravasated blood; and, in the centre

of it, were two distinct cavities lined by a very friable curdy-looking membrane, and containing portions of dead pulmonary tissue and very foetid pus, partially mixed with elotted blood. The vomicæ were respectively of the size of a hen's and of a pigeon's egg. Only a very thin film of tissue separated the larger cavity from the pleural sac, and it was apparently in a necrosed condition. The pleura covering the right lung was normal, but a small portion of the lung at its base posteriorly was deeply congested and scarcely crepitant. The remainder of this lung was quite healthy. No tubercles were found in any organ. The heart was natural.

Slight puckering was observed on the surface of the right kidney. The left kidney was larger than natural, and congested on its surface, but on section several small abscesses were observed in both its cortical and medullary portions; its pelvis was much dilated, and its ureter much thickened and increased in calibre. The bladder was almost empty, its muscular coat hypertrophied, and it was sacculated. Its mucous membrane was congested, and at several points ecchymosis had occurred. In the sacculated portion the mucous membrane was slightly ulcerated. On examining the perineum an abscess, of the size of a peach, and containing very foetid pus, was found on the right side of the bulb of the urethra, but not communicating with that channel. Another smaller abscess was observed at the junction of the scrotum with the perineum, and into this the catheter had evidently passed instead of into the urethra, which was contracted at this point.

Remarks.—This is an instance of suppurative fever following one of the simplest operations in surgery—

the introduction of a catheter into the bladder. The fever pursued its course rapidly, commencing in an insidious manner on the third day after admission—that is, after the first attempt at introducing the catheter—with pulmonary symptoms, which two days subsequently became unmistakably pneumonic, and terminated in collapse.

The only symptom in this case to be noted as unusual, is the smart hæmoptysis which occurred on the second day of the fever.

The treatment of this patient, as will also be remarked in most of the subjoined cases, consisted in the use of means deemed best for combating symptoms as they occurred, and in the employment of stimulants and nutritive diet to support the system.

The autopsy is of especial interest, as illustrating the very serious destruction of tissue produced by this disease in a comparatively short space of time. The pneumonia of the left lung, detected during life in the stage of engorgement, passed during a few hours into the suppurative or necrosed condition; and it was, probably, in consequence of this rapidity that the hæmoptysis took place from one of the two large vomicæ found at the post-mortem examination. The abscesses observed at the neck of the bladder and in the perineum showed that phlebitis had probably preceded the formation of the metastatic abscesses met with in the internal organs.

CASE II.—A. J. was admitted into hospital on March 16, with Compound Fracture of the Humerus. The injuries were caused, shortly before admission, by a loaded railway truck passing over the arm. The

patient, on admission, was recovering from very severe shock, and from the effects of a considerable loss of blood. Primary amputation of the arm was performed without the use of chloroform.

The patient did well for a month after the operation, and by this time all the ligatures had separated. His pulse was 84.

On the twenty-eighth day after admission (April 12), rigors occurred and were followed by fever. His pulse was 120, his tongue furred, and he had no appetite for food. His thirst was great, and his expression very anxious. There was a thin and scanty discharge, with pale and flabby granulations.

Next day the patient had two more rigors, followed by profuse perspiration and great debility. Treatment consisted in the use of stimulants and tonics.

Four days later, 17th April, the patient complained of pain on the left side of the chest and in the left shoulder, with inability to move the left arm. He had also occasionally difficulty in deglutition, and the abdominal muscles were very rigid. His pulse was 130. Rigors and profuse perspirations continued to be experienced. He was ordered to have two grains of sulphate of quinine thrice daily, and the compound tincture of iodine was painted over the affected shoulder.

On 21st April the typhoid character of the fever became marked. The patient was emaciated, and had a haggard and worn-out expression. There was great pain in and twitching of the muscles of the left shoulder and side of the neck. His pulse was 130, and very weak. No cough was complained of. He was ordered five drops of tincture of aconite (P. L.) thrice daily.

The depression of the system progressed uninter-

ruptedly till the patient sank two days later, April 23, on the twelfth day after the commencement of the fever. He had rigors daily till his death. No fluctuation nor swelling was observable in the left shoulder-joint, and the pain complained of was relieved by the application of iodine. Before death an abscess formed over the sacrum.

Pathological Appearances.—The autopsy took place thirty hours after death. The body was much emaciated, and decomposition was commencing. Rigor mortis was very feebly marked. The left brachial plexus was observed to be healthy; but in the axilla, beneath the pectoralis minor, the nerves were found to be surrounded by small abscesses. From the branches of the axillary artery the blood flowed freely, and had the appearance of water in which raw meat had been washed. The left shoulder-joint contained pus, and its cartilage was eroded and partially detached. Pus was present also in the left sternoclavicular articulation. The spinal cord was healthy, but the intraspinal veins were greatly congested. The rest of the body was not examined.

Remarks.—In this instance were present the chief predisposing causes to depression of the vital powers, viz., hæmorrhage, and very severe constitutional shock induced by the form of injury, and aggravated by the performance of amputation without chloroform. The fever did not, however, show itself till a month after the operation, when all risk was supposed to be past, and when the patient was allowed comparative freedom. In looking for an exciting cause we are baffled, no pneumonic symptoms being present during life. The accession of the fever at a date so long after

the ordinary sources of septic infection were removed, is also a striking feature in this case, and one which is frequently presented by suppurative fever.

The treatment of this case does not deserve special attention, seeing it consisted in the use of quinine, stimulants, and nourishing diet.

It is to be regretted that, owing to the great objection of the deceased's relations, a more complete post-mortem examination was not made. What was found at the autopsy proved, however, that the disease was suppurative fever, and that there were present, during life, numerous sources of purulent infection in close relation to the main vessels. The disorganisation of the articular structures was found to have progressed very rapidly, and was far more serious than the symptoms exhibited during life implied. Still the solution of the problem—how did pyæmia originate in this instance?—remains to be discovered.

CASE III.—B. D., æt. 15, was admitted on December 4, 1864, on account of a Medullary Tumour of the Arm.

The tumour was first observed three years ago, when it was as large as a filbert, but caused no pain or inconvenience. Since then it had grown gradually, and without seemingly affecting the patient's health. It had been treated with discutient remedies, had been punctured under the supposition of being an abscess, and part of it had been removed in February last, since which time the growth of the tumour had been very rapid, and hæmorrhage from the ulcerated part had repeatedly occurred. The tumour occupied the whole of the upper part of the arm. The patient presented an anæmic appearance, and the second cardiac sound

was accompanied by an anæmic bruit. His appetite was good and his spirits unaffected. The axillary and subclavian lymphatic glands were not sympathetically indurated.

On December 6 the limb was removed at the shoulder-joint, and during the operation considerable venous hæmorrhage took place, owing to the dilated condition of the superficial veins. This patient's arterial blood was observed to be abnormally dark. After the operation he showed a tendency to collapse, but this was prevented by the liberal administration of stimulants. In the evening the patient was wonderfully well.

On the second night after the operation he was slightly feverish, but these symptoms soon passed off. Opiates were required to procure sleep.

The report on December 15 was, that the patient's appetite was good, and that he was cheerful. All the ligatures, except that on the main vessel, had separated. The part of the wound which previously seemed to be healing by the first intention had not done so, and its whole extent was covered with granulations. The wound was dressed with *lotio sodæ chlorinatæ*, and washed with tepid water containing Condyl's fluid. The constitutional treatment consisted of stimulants and tonics.

Secondary hæmorrhage from the axillary artery set in at mid-day of December 21, exactly fifteen days after amputation. On the morning of the same day severe rigors were experienced. The vessel was ligatured higher up without much blood being lost. The inner surface of the flaps, especially of the anterior one, looked very unhealthy, being of a greyish colour and glazed.

On the following morning the patient took a good

breakfast, but was very thirsty. His bowels were costive, and his tongue slightly furred. The interior of both flaps was touched with strong nitric acid.

Three days later the patient experienced slight rigors, called by him "grueings," which soon passed off; but his breath was observed to have a sweetish odour. He was very restless at night.

Next day he had rigors and profuse perspirations, with other markedly pyæmic symptoms.

During the two following days vomiting occurred, and was succeeded by delirium and by the icteric coloration of the skin. Opiates continued to be given at bed-time.

The patient gradually sank and died on January 2 on the twenty-eighth day after amputation, and the twelfth after the first rigors were experienced. Vomiting and delirium were present to the last, and the pyæmic colour of the skin became more and more pronounced.

A post-mortem examination could not be obtained.

Remarks.—In this case we meet with certain predisposing causes different from those we observed in the preceding. Loss of blood on repeated occasions; and the presence of a medullary tumour, produced in B. D. an anæmic and cachectic state of the constitution, very unfavourable for recovery from a protracted illness or severe shock. Though regarded as healthy by his relations and himself, the anæmic cardiac murmur was in itself an important indication of imperfect blood-formation.

The point chiefly noticeable in the above-mentioned symptoms is their periodical return daily and weekly. Commencing with derangement of the alimentary canal, we observe, next, rigors; then the characteristic



hay-like odour of the breath; and lastly, the icteric tinge. The delirium was, no doubt, caused by an imperfect vascular supply to the brain resulting from a weakened state of the constitution.

M. Bonnet and other surgeons lay great stress on the application of the actual cautery and of escharotics to the sloughing unhealthy stumps of pyæmic patients, —believing that, by this means, the chief source of the contamination of the system and of the continuation of the disease, is removed. In the present instance, notwithstanding a free employment of strong nitric acid, the stump never exhibited a truly healthy surface after the occurrence of secondary hæmorrhage.

CASE IV.—G. H., aged 26, was admitted on January 16, 1865, with Compound Comminuted Fracture of the Leg extending into the ankle-joint.

The patient was a railway labourer, of intemperate habits. About six hours before admission, while disengaging the horse from a truck, he was knocked down and the loaded truck passed over the limb. On admission into hospital he was found to have sustained a compound and comminuted fracture of the left tibia and fibula, into the ankle-joint; and the leg was greatly swollen. The wounds leading to the fracture were very small. The patient appeared to be intoxicated, and was with difficulty roused to answer questions correctly. The limb was adjusted in a M'Intyre splint, and cold was applied. He slept well during the night.

Next day he was quite conscious, and complained of great pain in the fractured limb.

In the course of the following day rigors occurred. The pulse was 82, and full. His appetite was good,

but his tongue was furred, and his bowels were costive.

On the sixth day after admission the patient became restless and was confused in his ideas.

The cerebral symptoms became markedly those of delirium tremens during the ensuing day. His pulse was 84. He perspired profusely, but his appetite remained good.

January 23.—He was very restless during the night and talked in his sleep. He suffered from hallucinations, like those of a person in delirium tremens—supposing himself to be surrounded by evil spirits. His pulse was 80, and full. Treatment consisted in the administration of opium in large doses, and of nourishing food.

These cerebral symptoms increased in violence, so that he required in a few days to be removed to a ward especially provided for maniacal and noisy patients. He attempted repeatedly to get out of bed, and was so restless as to require to be strapped to it. He had occasional lucid intervals between his severe maniacal paroxysms; but the severity and character of the cerebral affection continued much the same till his death on February 8—on the twenty-third day after the accident, and the twenty-first after rigors were first experienced.

Pathological Appearances.—There was found a compound comminuted fracture of the left tibia and fibula, into the ankle-joint. The heart was enlarged, and had some imperfectly coagulated blood in its cavities. Both lungs contained numerous secondary abscesses in different stages of development, and their surfaces were covered with patches of recent lymph.

The liver exhibited a dark greenish hue, not the result of decomposition. The kidneys were normal. The spleen was enlarged, soft, and pulpy. The intestinal mucous membrane was in some parts congested.

There were numerous secondary abscesses observed in different parts of the body, but they did not appear to communicate with any of the neighbouring veins. One of large size was situated in the right psoas muscle.

The cerebral vessels were congested, but no abscess was discovered in the cranial cavity.

Remarks.—This case illustrates well the severe cerebral symptoms which are sometimes met with in suppurative fever. Predisposed by intemperate habits, this patient, at an early stage of the disease, exhibited signs of mental derangement increasing to violent delirium, which continued unabated to the last.

The periodical character of suppurative fever may be again remarked,—the patient dying exactly at the end of the third week after the commencement of the fever. The pulse, it will be noted also, was never very rapid; and there was almost complete absence of the profuse perspirations, peculiar icteric tinge, and repeated rigors, which are the chief symptoms of this disease. In this case the symptoms during life were mainly those arising from nervous irritation; but the pathological appearances observed after death point to a general septicæmia.

In order to make these reports of cases as brief and interesting as possible, only the peculiar features of each case are mentioned in detail. Accordingly, the treatment of this patient, G. H., is passed over in silence, seeing that it consisted, for the most part,

of the same measures as were used in the other cases.

CASE V.—A. M'V., æt. 44, was admitted on January 17 with Disease of the Wrist-joint, which followed a blow on the back of the hand received a year previously through the falling of a stone. The accident rendered the patient unable to work for eight weeks, but after that time he had followed his usual occupation as a labourer till four months ago. During the last nine weeks the joint had been discharging matter.

On admission, the joint was found to be thoroughly disorganised—very much swelled—with various sinuses leading to its interior. The patient was very weak—evidently the result of imperfect nutrition, bad lodging, and debilitating disease. He perspired greatly by night, and had been losing flesh lately. His appetite was good. On auscultating his thorax, vocal resonance was found increased at the right apex, and percussion detected dulness over the same region.

On January 24, a week after admission, the limb was amputated above the wrist-joint.

After the operation the patient was put on a nourishing and tonic course of treatment, and progressed favourably till the morning of the 30th inst.,—the seventh day after the operation,—when he experienced a rigor which lasted half an hour. The wound looked healthy, and so did the discharge from it. His appetite was impaired, and his bowels rather costive. The pulse was 80, and strong. The medicinal treatment prescribed consisted of large doses of quinine, and potassæ chloras (ʒij. to aq. Oj.), used as a drink.



Three days subsequently the patient's breath had a heavy sweet odour, his skin and conjunctivæ exhibited the characteristic pyæmic coloration, his pulse was very rapid and weak, the wound looked unhealthy, the discharge being less in amount, and of a bluish-green colour, and the sawn extremity of the radius was necrosed.

The fever pursued its usual course, and terminated fatally on February 4, the fifth day after the first rigor occurred. The symptoms observed at last were purely typhoid,—viz., profuse perspirations, weak irregular pulse, hurried respiration, inability to swallow, and wakefulness.

An autopsy was not obtained.

Remarks.—This patient—debilitated by want of food, bad lodging, hard work, and wasting disease—was indeed a pitiable subject for amputation. Presenting the physical signs of incipient phthisis, and with a weakly constitution, the only inducement for amputation was the certainty of removing the source of constant constitutional irritation. To delay till the patient's general health was improved by hygienic measures was impossible, in consequence of the articular disorganisation steadily reducing his strength, and causing such pain as to require large opiates at night. Notwithstanding the premonitory signs of pulmonary affection present in this case, he had no cough or expectoration. His digestive system became first of all disordered, and soon thereafter rigors ushered in the characteristic symptoms of suppurative fever. Quinine, which was at this time vaunted as an efficient remedy in pyæmia, was administered to this patient, with steel and stimulants. Various disinfectant lotions were used locally.

CASE VI.—Cl. M'Q., aged 35, was admitted on April 19, with Anchylosis of the Elbow-joint. The patient was a strong, healthy-looking Irishman, and, to all appearance, a very favourable subject for operation. The articular disease was ascribed to a severe twist of the arm received about eight months prior to admission. The pain was, at the moment of accident, intense ; and medical advice on the matter was followed. In about four or five weeks after the accident the patient was able to resume his work ; but after some time he became again disabled.

The patient, on admission, complained of a “ heavy pain ” in the affected joint, which was very stiff ; and the arm was partially wasted. He said he had always been a temperate man. As several operation cases were in the same ward as the patient at this time, excision was delayed ; and meanwhile hygienic means were used to improve his health.

On May 16, nearly one month after admission, the elbow-joint was excised by the simple linear incision. By this time the patient had got accustomed to hospital life ; and, seeing he was allowed to go much into the open air, his health was as good as could be desired. The operation was uncomplicated.

Four days after the operation the patient experienced a slight rigor, followed by cold perspiration. Soon after he complained of cough, and of a slight pain in the lower part of the chest, for which a poultice was ordered. During the night he was delirious and very restless. The wound looked healthy, with the exception of slight erythema around it. The ligatures separated on this day.

On May 22 the patient was rather better. He was

less delirious, and had slept better. His face was still flushed, but no pain or uneasiness in the thorax was complained of. His appetite was not good, and his bowels were costive. The urine was of a brick-red colour, and deposited a mucous cloud. The sputum was plentiful, viscid, and contained rust-coloured nummuli. The wound appeared healthy.

On the following day the patient was in much the same condition ; but profuse perspirations occurred, and the arm and forearm were covered with an erythematous blush. The discharge from the wound was less in quantity, but healthy in appearance. The delirium had passed off. Sputum was expectorated in large quantity, and it contained purulent nummuli. The treatment consisted of stimulants and good nourishing diet, with opiates at bedtime, and large doses of quinine four or five times daily.

TABLE OF THE PULSE.

Date.	Pulse.	Date.	Pulse.
Normally.	65	May 25	90
May 16, Vesp.	72	„ 26	84
„ 18	62	„ „ Vesp.	78
„ 19	70	„ 27	76
„ „ Vesp.	66	„ 28	82
„ 20	68	„ „ Vesp.	80
„ „ Vesp.	64	„ 29	90 and
„ 21	66		wiry.
„ 22	84	„ „ Vesp.	76
„ 23	70	„ 30	72
„ „ Vesp.	72	„ 31	70 and
„ 24	100		very weak.

The erythematous blush extended gradually over the whole back of the trunk, but the patient's general condition altered little during the ensuing days. The dis-

charge from the wound gradually assumed an unhealthy colour and odour, and diminished in quantity ; but the surface of the wound looked healthy.

On May 26 the patient had rigors, followed by profuse perspirations. On examining his thorax, double pneumonia of the lower half of both lungs was detected. His appetite was good, and the wound had a healthy appearance ; but there was no discharge. There was extensive erythema covering the whole back of his trunk. He was ordered fifteen drops of tinctura ferri muriatis and two grains of quinine every four hours. The wound was washed and dressed with disinfectant lotions.

The symptoms of suppurative fever developed themselves daily in a more and more marked degree. On May 27 his breath was observed to have a sweetish odour, and his urine was albuminous.

On May 28 the icteric tinge was very distinct, and was combined with a furred, dry tongue, slight delirium, and strongly ammoniacal urine. The dose of iron was increased to half a drachm every two hours. Rigors recurred from time to time. The discharge from the wound was scanty, sanious, of a bluish-green hue, and of very foetid odour. Delirium increased in severity. The same local treatment was continued.

Thus the fever progressed till it terminated fatally on May 31.

Pathological Appearances.—There was some bloody serum found in the pericardium. The blood in the vessels was partially coagulated. The structure of the heart was healthy, but some old lymph was observed on its surface. Each pleural cavity contained a little sero-purulent fluid, tinged with blood. Both lungs

were oedematous, congested, and exhibited numerous secondary abscesses in various stages of development.

The hepatic tissue was soft, friable, and fatty. The spleen was somewhat pulpy, and contained secondary abscesses in the early (congestive) stage of formation. The kidneys were soft, swollen, and flabby.

On opening the cranium, the dura mater was observed to be adherent to the calvaria over the posterior third of the right hemisphere, and some lymph was present on the surface of the brain at this point. The subarachnoid fluid was increased in quantity. The cerebral substance itself was very oedematous and slightly congested. The choroid plexuses were remarked to be unusually devoid of blood.

The wound was thoroughly unhealthy and ununited; the soft tissues around it appeared macerated, and of a greenish colour; the ends of the bones were bathed in greenish, foetid pus, and showed signs of commencing necrosis.

Remarks. — “Excision of the elbow-joint,” says Professor Erichsen, “so far as life is concerned, is a very successful operation.” Hence, a case like the one at present under consideration becomes worthy of note. From the patient’s account of his previous health and habits, from the nature and simplicity of the operation, from the absence of complications in the operation, and from the progress of the case till the accession of the fatal fever, we obtain no clue as to either a predisposing or an exciting cause of pyæmia. The first rigor was experienced on the fourth day after the operation, and was accompanied by disorder of the digestive system. In a few hours thereafter the first symptom of pneumonia presented itself, viz., uneasiness in the

lower part of the chest posteriorly. Never free from cough and the expectoration of viscid sputum, containing (at a later date) purulent and rusty nummuli, troubled with occasional rigors and profuse perspirations, the patient sank gradually in a delirious state.

The tonic treatment was, in this instance, pushed as far as is possible, but had no effect in cutting short the disease.

In the above account of the autopsy, one point deserving of note is, the extremely anæmic condition of the choroid plexuses. This I have observed in many instances of suppurative fever.

The exposure of the sawn ends of the radius and ulna to the imbibition of septic matter from the surrounding unhealthy discharge, would by some be regarded as the exciting cause of pyæmia in this patient.

During the course of the disease, when the symptoms were unmistakably those of suppurative fever, a quantitative analysis of the urine was made, and this revealed a *slight deficiency of urea* in that fluid.

CASE VII.—H. J., æt. 14, was admitted into hospital on May 24, with Rupture of the Perineum and Urethra. The injuries were received about twenty hours before admission at a railway station fully forty miles distant. On examination, the perineal wound was found to be small, and was enlarged with the knife; then the urethra was discovered to be torn through in front of the prostate, and the anterior half of the sphincter ani was likewise completely severed. The rectum was considerably lacerated. A metallic catheter was passed into the bladder, and this organ was thereby emptied.

The attempt thereafter to pass a flexible catheter having proved unsuccessful, the urine was allowed to trickle through the wound.

On the third day after the accident the patient was somewhat feverish, and had a cough. Auscultation and percussion disclosed bronchitis in the upper half of the left lung, pleuropneumonia in the lower third of the right lung, and bronchitis in the remaining portion of the same lung. An expectorant and diaphoretic mixture was ordered. The wound looked healthy, and the passage of urine along it caused no pain.

On the following day a metallic catheter was again passed into the bladder, and retained. The febrile and pulmonary symptoms continued to be much the same as formerly. His tongue was furred, and his appetite not so good as before. Rest at night was obtained by opiates. The wound looked healthy.

The pulmonary affection increased in severity, and great pain was felt in the wound during coughing. Owing, however, to the patient gradually becoming weaker, a careful examination of the thorax was not again attempted. His appetite was good; but his tongue was furred, and its papillæ in front were very prominent. Nourishing diet and stimulants were freely and frequently administered.

During the afternoon of May 31 the patient had a severe rigor, followed by heat of the surface of the body, and by profuse perspiration, which left him very weak. His urine was of a pale leaden colour, of strongly ammoniacal odour, of alkaline reaction, and contained an excess of urates and chlorides, with a small amount of albumen. His appetite was good, and the wound looked healthy. The pulmonary

symptoms were increased in severity. The inguinal glands on both sides were enlarged.

Diarrhœa occurred on the following day, and was checked by means of catechu and opium.

The patient, on June 2, became restless. The expression of his face was anxious. He complained of great oppression in the chest, and of a troublesome cough. Respiration was laboured; and his breath had a heavy, sweet odour. He ate little. The urine contained urates and phosphates in excess, and albumen. The wound appeared unhealthy. The patient sank gradually, and died on June 4, on the twelfth day after the accident, and the eighth after the first symptoms of suppurative fever showed themselves.

TABLE OF THE PULSE.

Date.	Pulse.	Date.	Pulse.
May 25	84	June 1	80
" 26	90	" " Vesp.	98
" 28	80	" 2	90
" 29	84	" 3	100
" " Vesp.	96	" " Vesp.	104
" 30	90	" 4	Very rapid
" 31	100		and weak.

Pathological Appearances.—At the autopsy, held about thirty hours after death, the body was seen to be undergoing decomposition rapidly. Slight rigor mortis was present. The tissues of the lower part of the pelvis, in the neighbourhood of the wound, were found much discoloured by putrefaction. The blood in the vessels of the body generally was partially coagulated. The ruptured extremities of the urethra were considerably separated from one another. Both lungs were

studded with numerous secondary abscesses of various sizes ; and several large patches of lymph covered the surface of the base of the right lung. No other organs were examined.

Remarks.—We have here a patient attacked by suppurative fever while making an unexpectedly favourable recovery from a very serious accident. The first symptoms were those of pneumonia and bronchitis, probably excited by the exposure to cold during the journey by train to the hospital. No distinct rigors ushered in the pyrexial condition, but a severe rigor preceded immediately the typhoid state. An eliminative diarrhoea next occurred ; but, owing to the already reduced state of the patient's strength, it showed a tendency to exceed a safe boundary, and was accordingly checked. As the chief symptoms exhibited by the patient, G. H. (Case IV.), were cerebral, so in this instance the lungs were most affected.

The treatment consisted in the administration of stimulants and good diet, with expectorant mixtures to relieve the cough, and opium at night to procure sleep.

CASE VIII.—J. L., aged 36, a labourer, was admitted on June 2 with Compound Fracture of the left Leg. The accident took place a few hours before admission, through the falling on the limb of a wooden beam, 18 feet long by 1 foot broad. During the twenty-four hours prior to the accident the patient had been constantly at hard work.

On admission, both bones of the leg were fractured at their lower third, and the upper fragment of the tibia projected through the wound. The limb was

adjusted in a M'Intyre splint, and the wound dressed.

Next day the patient had a cough, complained of pain in his chest and abdomen, and expectorated a small amount of purulent viscid sputum tinged with blood. His face was flushed, and his bowels costive. Opiates were required to procure rest at night. His appetite was bad, and his tongue furred. The oblique upper fragment of the tibia still projected through the wound, which looked healthy, and discharged well-formed pus.

On June 6 there was some erythema around the wound ; and the temperature of the limb was abnormally high. The constitutional symptoms remained much the same ; but the most troublesome now were flatulence and sleeplessness. A diaphoretic mixture was prescribed.

The pain in the chest, of which the patient had complained during the last few days, returned two days later on the left side. His appetite was bad. The wound looked healthy, and discharged freely.

The erythematous blush by-and-by disappeared, and the wound suppurated freely. Secondary subcutaneous abscesses next formed, requiring counter-openings to be made on the back of the leg. This afforded relief, and the patient's appetite improved. Stimulants (porter and wine) were freely given to support his strength, while poultices were applied locally.

On June 18 slight venous hæmorrhage from the wound occurred, but was easily arrested. His general health was good, and he took his meals heartily. An opiate at bed-time was still required.

No change worthy of note in the patient's condition took place till June 23,—exactly three weeks after

admission,—when profuse perspirations began to be experienced. The discharge from the wound also, though still abundant, was more watery in consistence, and grumous. His appetite began to fail, and his tongue was loaded.

TABLE OF THE PULSE.

Date.	Pulse.	Date.	Pulse.
June 3	70	June 26	94
„ 5	74	„ 27	100
„ 6	66	„ 28	90
„ „ Vesp.	76	„ „ Vesp.	110
„ 7	68	„ 29	96
„ 8	74	„ 30	120
„ 9	80	„ „ Vesp.	100
„ 10	80	July 1, Vesp.	94
„ „ Vesp.	76	„ 2	92
„ 12	80	„ 4	100
„ 15	70	„ 5	96
„ 16	80	„ „ Vesp.	108
„ 17	84	„ 6	120
„ 18	84	„ „ Vesp.	108
„ 20	84	„ 7	96
„ 21	90	„ 8	124
„ 22	84	„ 14	120 and very weak.
„ 23	88	„ 15	132
„ 24	78	„ 17	120
„ 25	80		
„ „ Vesp.	90		

On June 27 the pulse increased in rapidity ; and the constitutional irritation became greatly aggravated in consequence of want of sleep during the previous night. The profuse perspirations and disorder of the digestive system continued. The wound looked very unhealthy ; and the patient suffered very great pain in the broken limb.

Three days later, on carefully examining the thorax nothing abnormal was detected ; but the patient com-

plained of pain on coughing. The restlessness by night, occasional delirium, and other symptoms, remained much the same.

Seeing the patient's health was seriously injured by the irritation of the fracture and by the amount of the suppuration, and as the limb could not be saved, it was amputated below the knee-joint on July 1, one month after the accident.

Improvement in health followed the operation, and continued till the 4th July, during which night the patient had a severe rigor. The rigors recurred regularly every twelve hours till the evening of the 6th July. Profuse perspirations, hot skin, want of appetite for food, and restlessness at night followed. The wound looked sloughy at its edges. Several clots came away ; and the discharge, though copious, was unhealthy. He was ordered medicated drinks to alleviate his thirst ; and the stump was washed thoroughly twice daily with tepid water containing some of Condyl's disinfectant fluid.

Venous oozing from the stump occurred on July 8, but was easily arrested. The wound had a more healthy appearance ; but the patient's general health was not improved. The discharge from the stump was considerable in amount, and had a very foetid odour.

On July 11 he appeared to be better, and was much more cheerful.

Rigors recurred on the night of July 13, and during July 14, after which the patient showed signs of sinking. The wound gradually became stagnant ; the discharge was watery, foetid, and at last ceased. He died on July 19, which was the fifteenth day after the first rigor was experienced. Permission to make a post-mortem examination was not obtained.

Remarks.—In this instance we have suppurative fever occurring long after the original injury, and even after the source of constitutional irritation had been removed. The patient had a healthy constitution. His injuries were attended to soon after they were received. He was placed in a well-aired, clean ward, which was not at the time crowded, and in which there were no cases of serious surgical injuries or of operations. The symptoms presented by the fever were those usually met with ; a simple stimulant treatment, with strict attention to local disinfection, was observed, and no complication in the operation existed. Notwithstanding this, the patient's system made little effort at rallying after the operation.

The rigors exhibited a marked periodicity, but no system of organs was pre-eminently involved. The wound presented a healthy appearance till a short time before death.

CASE IX.—J. M., æt. 38, was admitted on June 27, 1865, with Compound Fracture of the right Leg into the ankle-joint, caused by a loaded railway waggon passing over it.

The patient had been addicted to intemperance, but had of late refrained from drinking spirits. He had always enjoyed good health. He was admitted into the Infirmary soon after the accident, and primary amputation below the knee was performed ; but about an hour after the operation reactionary hæmorrhage occurred, requiring the stump to be laid open while several vessels were ligatured. He was ordered four ounces of sherry daily and tonics, with an opiate at bed-time.

On the second day after amputation the patient received purgative medicine, which acted freely, after which he felt better.

It was reported, two days later, that his expression of countenance was anxious, and that he perspired profusely. His appetite for food was improved, but his tongue was still furred and his bowels costive. The superficial veins passing from the stump were inflamed, and the skin around the wound had an erythematous blush. About one inch and a half of the edge of the posterior flap was sloughing away ; but the rest of the stump looked healthy, and there was a copious discharge from it. The same constitutional treatment as in the other cases—consisting of tonics, stimulants, and an opiate at night—was pursued. *Lotio plumbi e. opio* was applied over the inflamed limb.

During the afternoon of the following day delirium set in, the patient fancying that he saw people and objects dancing about his bed. The stump looked very unhealthy, and the discharge from it was small in amount ; accordingly a charcoal poultice was applied over it. No opiate was administered at bed-time, but stimulants were freely and frequently given during the night, the result being that the patient slept well, and had no delirium next morning.

The phlebotic affection of the thigh with its sequences—tenderness and swelling of the limb through the exudation of serum—progressed, but no pulmonary symptoms showed themselves.

On July 4 the patient did not recognise his wife, he fumbled at the bed-clothes with his fingers, had muttering delirium, and passed his urine in bed. Profuse perspiration occurred at intervals daily, and the dusky

icteric tinge showed itself in the conjunctivæ and face. He ate well, and received large quantities of sherry and brandy daily. The stump was washed and dressed with tepid water containing Condyl's fluid.

On July 6 he complained of stiffness across the shoulders. The right thigh and the stump were swollen and tense ; and there was a feeling of boggi-ness, and some discolouration of the skin at the inner and lower portion of this limb near the knee. His appetite was better, and he slept better, but he was very weak.

TABLE OF THE PULSE.

Date.	Pulse.	Date.	Pulse.
June 27, Vesp.	82	July 1	90
„ 28	72	„ „ Vesp.	84
„ „ Vesp.	97	„ 2	92
„ 29	106 and weak.	„ 4	100
„ „ Vesp.	92 and stronger.	„ 5	108 and weak.
„ 30	84	„ 6	108
„ „ Vesp.	96	„ 7	120 and very weak.

Delirium again set in, and profuse perspirations gradually reduced the patient's strength ; the stump became sloughy and stagnant, and the patient died at mid-day of July 8, on the seventh day after the first symptoms of suppurative fever showed themselves.

Permission to examine the body was not granted.

Remarks.—The absence of rigors and of many of the characteristic symptoms of suppurative fever is here to be remarked. Besides the local phlebitis, the symptoms in this case point only to a weakened state of the system. The two unfavourable occurrences in this instance

were, the conveyance of the patient, at 2 A.M., from a considerable distance to the hospital (out of one vehicle into another), and the subsequent accession of reactionary hæmorrhage. It may be here remarked that the very frequent supervention of suppurative fever, after primary amputation performed on individuals who have been conveyed from considerable distances into hospital, as compared with those instances in which the limb has been removed at once, on or near the spot where the injury has been received, and the patients have not been subjected to the evils of conveyance, leads us to the conclusion that it would be more advantageous to the patient to be carried to as short a distance as possible after the reception of a serious injury. It very frequently surprises surgeons, who have much experience in operating after railway accidents, to observe that when amputation for such injuries is performed on the spot, and the patient is carried into a neighbouring cottage, where he is provided with no luxuries except quietness and fresh air—and where, perhaps, he is barely supplied with the necessary amount of sustenance—nevertheless, in few of such cases does suppurative fever supervene, as compared with those cases in which the patient is conveyed to a distant hospital before being operated on. This fact adds support to the recently proposed system of cottage hospitals. It is not, however, the isolating of the patient, but the freedom from fatigue thus secured, which appears to be so beneficial to one who is treated in a cottage instead of in an infirmary.

Unfortunately there was no autopsy in the case of J. M., else more light as to the nature of the pathological lesions in this instance might have been obtained.

This case, placed immediately after one of a similar nature, may be compared with it. The injuries were nearly analogous; but while in the former instance secondary amputation was performed, in the latter it was primary amputation. In the latter patient, moreover, the constitution was more or less injured by previous intemperance; and combined therewith we find certain predisposing causes—the nature of the accident, and of the cause producing it, and the occurrence of reactionary hæmorrhage which served to excite phlebitis and its sequence suppurative fever. Unlike the previous case, the wound in this instance assumed early an unhealthy appearance.

CASE X.—R. T., aged 40, was admitted on June 21, 1865, on account of Disease of the Right Ankle-joint of two years' duration. It was only four months before admission, however, that the joint became so troublesome as to require surgical advice.

On June 27 the limb was removed according to Syme's method. The patient's complexion was ruddy, and his temperament neuro-arthritic. He said he had always enjoyed good health, and had been a temperate man. His appetite was good. He was ordered four ounces of sherry daily.

On the third day after the operation the patient experienced a slight sensation of cold passing over his body; but this feeling, by the use of external warmth and of warm cordials, passed off in a few minutes. Soon thereafter slight venous oozing from the stump occurred. He had also diarrhœa, which was arrested by medicine. He slept well at night without opiates.

These symptoms were followed next day by profuse

perspiration, disinclination for food, furred tongue, and by a greenish-blue colour of the discharge from the stump. The treatment employed consisted of stimulants and tonics, with the local use of disinfectants.

Rigors occurred from time to time, diarrhœa appeared at intervals of a day or two, the profuse perspirations continued, and the wound became gradually sloughy, and ceased to discharge. The patient's appetite, however, was not impaired; and no pulmonary or cerebral symptoms were developed. Secondary abscesses formed on the face, over the left shoulder, and on other parts of the surface of the body, and were evacuated with temporary relief. By degrees the patient sank and died on July 25.

TABLE OF THE PULSE.

Date.	Pulse.	Date.	Pulse.
Normally	84	July 6	108 and
June 28, Vesp.	104		stronger.
" 29	114 and	" " Vesp.	96
	weak.	" 7	108
" " Vesp.	106	" 9	100
" 30	104 before	" 10	98
	hæmorrhage	" 12	102
	occurred.	" 14	110
" " Vesp.	92	" 15	120 and
July 1	108		very weak.
" " Vesp.	102	" 19	114
" 2	100	" 21	108
" 4	102	" 24	weak, and
" 5	108		very rapid.
" " Vesp.	116 and		
	very weak.		

Remarks.—This patient appeared to be healthy, and he received suitable preparatory treatment during a week of hospital residence prior to the operation. Amputation at the ankle-joint is generally regarded as one

of the major amputations attended with least risk to the life of the patient, and in this instance no complication was met with in the operation. The patient progressed as favourably as could be desired for three days after amputation ; but after this time his pulse became rapid and weak, while the discharge from the stump assumed a bluish-green colour and was of foetid odour.

The same constitutional and local treatment was employed as that mentioned in the previous cases. Nature seemed to desire to get rid, through the skin and intestinal canal, of the poison imbibed ; but the patient's strength failed ere complete elimination had been effected.

The stump was affected at an early date by the typhoid state of the system. After a few days of stagnation it again secreted pus freely ; but the discharge was watery, and had a bad odour. The patient next complained of wandering pains all over his body, which were worst in the larger joints. Subcutaneous abscesses formed, and were opened from time to time. The abscess which formed near the left shoulder-joint contained a large quantity of unhealthy pus, which was secreted in considerable amount ; and at the bottom of this cavity the clavicle was found necrosed.

CASE XI.—J. M., æt. 30, a joiner, was admitted into the hospital on July 15, 1865, with a Wound into the Knee-joint, caused five weeks previously by the fall of an adze.

For a fortnight after the accident no pain or inconvenience from the injury was experienced, till one day about three weeks before admission the patient

was seized suddenly with a severe pain in the joint, causing a feeling of sickness. Rigors immediately succeeded; and soon thereafter swelling of the joint. Under medical supervision, poultices and other remedies were used without avail.

On admission, a wound, an inch long, was found on the inner side of the knee-joint, which was fluctuating and greatly swollen. The patient's general health was good. Treatment consisted in the administration of large doses of *tinctura ferri muriatis*, and in the application of fomentations over the affected joint.

The suppuration of the soft tissues of the joint became more and more evident, requiring incisions to be made for the evacuation of grumopurulent fluid. Pulse 70.

The first rigor was experienced on July 28, and was succeeded by profuse perspiration. The patient's appetite for food was good, and he slept well at night. There was a large amount of healthy discharge from the affected joint. Pulse 102, and weak.

He had several rigors daily till July 31, when he was evidently much weaker. His breath was observed to have the characteristic pyæmic odour. Pulse 110. He complained of a sensation of oppression in the chest, and his respiration was laboured. The profuse perspirations continued; his appetite for food became impaired; and the discharge from the diseased joint gradually diminished in quantity, and was foetid, and of a greenish colour.

On August 2, which was the fifth day of the fever, the patient became partially unconscious and very deaf. His conjunctivæ and skin assumed the peculiar ashy-yellow tinge. Pulse 90. His voice was weak and husky. The discharge from the joint was scanty in

amount, and had a more unhealthy appearance than formerly. The patient had only one rigor yesterday, and none to-day.

Restlessness, passing into delirium, next set in, and was followed by unconsciousness. He became quite deaf, but showed no signs of paralysis. He died on the afternoon of August 3.

Pathological Appearances.—The autopsy on August 7th revealed the face and surface of the body of a yellow colour. The features were wasted and shrunken. The contents of the cranial cavity were healthy.

On the right side of the thorax the pulmonary pleura was found to be firmly adherent to the walls of the cavity throughout its entire extent. The right lung was œdematous, but no secondary abscesses were discovered in it. No signs of pleurisy existed on the left side of the thorax. The left lung was slightly emphysematous along its anterior margin, œdematous at its apex, and in its lower half contained numerous secondary abscesses, some of which formed cavities.

The liver was normal, and weighed 3 lbs. 3 oz. The spleen was of natural size, weighing 8 oz. The kidneys and intestinal canal were healthy.

The cartilage of incrustation on the head of the tibia and condyles of the femur, especially on the internal one, was ulcerated; and the subjacent cancellated tissue was partially carious. The soft tissues around and in the interior of the diseased joint were disorganised by suppuration; and its cavity was filled with extremely foetid, greenish-coloured pus. The femoral vein of the same limb was filled with a firm coagulum. None of the other joints were diseased.

Remarks.—This case furnishes an example of phle-

bitis, followed by that febrile condition to which, characterised by certain definite symptoms, the term pyæmia or suppurative fever is applied. Nothing in the symptoms, in the course of the disease, in the treatment pursued, or in the pathological lesions discovered after death, is deserving of note in this instance.

Wounds into joints are not so frequently followed by suppurative fever as are injuries in which there is a solution of continuity in the osseous tissue. Hence some surgeons have advocated amputation through a joint in preference to amputation through the shaft of a bone.

CASE XII.—J. B., æt. 40, was admitted into hospital on September 27, 1865, with Chronic Suppurative Fever.

The patient's account of his illness prior to admission into the hospital was very unsatisfactory, and shed very little light on the nature of his case. He stated that during the last four months he had been under medical treatment for "liver-disease." His medical attendant, on separate occasions, opened an abscess in the hepatic region, and another in the right groin, both of which communicated with each other, and, as was afterwards discovered, were due to the same cause. These incisions gave relief, but the patient's health gradually failed.

So weak was the patient on admission that he required to be carried at once to bed. On making a physical examination of the chest, no pulmonary or cardiac disease was detected; but owing to his weakly condition the examination was hurried. Sinuses leading to the afore-mentioned hepatic abscess were

found discharging very large quantities of foetid but healthy-coloured pus. The amount of discharge was so great as to require the bed-clothes to be changed very frequently, notwithstanding that large quantities of tow were applied over the wound to absorb the discharge. His skin had the dusky, icteric tinge. He was subject to profuse perspiration. His appetite was bad. His abdomen was very painful on pressure. He presented the appearance of extreme debility. He was ordered to receive stimulants, tonics, and nourishing diet in large quantities.

A marked improvement in the patient's condition resulted, till by-and-by he was able to sit on a chair, and to walk a little about the ward.

On October 18 the patient felt a sudden and severe pain in the abdomen, followed by extreme weakness.

Six days later he complained of stiffness in the neck, and intense pain on the slightest movement, which came on suddenly, and was relieved somewhat by an opiate. These symptoms gradually passed off, and were followed by strabismus of the left eye, unconsciousness at intervals, and drowsiness.

An abscess formed at the umbilicus some days subsequently, and was incised. The patient sank by degrees, and died on October 27. Before death he lost control over his sphincters, had priapism, and was comatose ; but no convulsions occurred.

Pathological Appearances.—The body was greatly emaciated. On opening the cranium a considerable amount of serous fluid was observed within the cavity of the dura mater, and in the ventricles. The cerebral substance was soft, and could not bear handling. An abscess was found situated in the space between the

right cerebral hemisphere and the right lobe of the cerebellum, disintegrating the tissue of the latter.

Some serous fluid was found in the pericardium and in both pleural cavities. The right lung was adherent at its lower half to the walls of the right side of the thorax, and its base was inseparably attached to the diaphragm by old pleuritic adhesions.

The liver was greatly enlarged; the hepatic vascular system was engorged; and the hepatic organ was adherent to the diaphragm, to the abdominal parietes, the stomach, and the duodenum. All these organs were agglutinated by lymph formed evidently during both older and more recent attacks of circumscribed peritonitis. At the lower border of the right lobe of the liver was a large abscess, lined by a thick, well-formed membrane, and traceable externally as far as the incision made by the surgeon in the right hypochondrium. The spleen was very congested, friable, and at several points had the appearance of commencing secondary abscesses. The kidneys were healthy.

Remarks.—We have here a good example of chronic idiopathic suppurative fever. Though the disease from time to time assumed an acute character, rapidly breaking down the tissues of important organs, it for the most part pursued its ordinary course slowly, reducing the patient's strength, and finally proving fatal through the excessive amount of the local discharge, and in consequence of the development of secondary abscesses.

As will have been observed in most of the previously narrated cases, the lungs contained metastatic abscesses, and the spleen showed signs of incipient secondary purulent deposits. In this instance we meet with a compara-

tively rare pyæmic lesion, viz., abscess within the cranial cavity. The hepatic abscess was lined by a distinct membrane; and this was probably the source of the excessive discharge which during life led to the diagnosis of an abscess of much larger size than was found at the autopsy.

CASE XIII.—C. S., a sailor, æt. 48, was admitted into hospital on July 18, 1866, with an extensive Carbuncle, which had been observed for the first time as a boil on the back of his neck above five weeks prior to admission. The abscess was allowed to burst; and, in spite of medical treatment, the disease spread rapidly. The patient's health next became affected; he lost appetite for food, and became very weak.

When admitted into hospital the whole upper half of the back of the trunk and the back of the neck presented a black and sloughy appearance, while the centre of this mass of disorganising tissues was red and angry-looking. A small amount of unhealthy foetid pus was discharged by the above mass. The constitutional treatment prescribed was a purgative, followed by alteratives, with a good nourishing diet, and a pint or more of porter daily as the patient desired. Locally, charcoal poultices were applied over the carbuncular mass twice daily.

The whole of the slough separated on the fourth day after admission (July 22), and disclosed a very perfect dissection of the first layer of muscles of the back of the neck and upper half of the dorsal region, as far as the lower margin of both latissimi dorsi. The raw surface was accordingly lozenge-shaped, and the granulations looked healthy. In addition to his former diet

the patient was ordered to receive daily four ounces of whisky, with a pint of the strongest beef-tea, and two eggs. Fifteen drops of tinctura ferri perchloridi thrice daily were prescribed. The wound was dressed with disinfectant lotions twice a-day.

The patient's health improved after the separation of the slough, so that he was able to get up and go about all day. The same treatment as formerly was persevered in.

On August 26, however, nearly a month after admission, the patient's face was observed to be flushed ; his skin was hot and dry, and his tongue furred and brown. He said he had had no rigor, but had been rather purged during the last day or two. He denied having any cough or expectoration. His respiration was laboured. He had profuse perspirations. The granulating surface on the back looked unhealthy, and the amount of discharge from it was much diminished in quantity. The same treatment as before was pursued.

Four days later the patient died. The symptoms before death were those of suppurative fever ; but they were not well pronounced, nor did they point to disease of any special organs. The wound was stagnant before death, and the spinous process of the sixth cervical vertebra was necrosed.

Pathological Appearances.—The body was much emaciated and had a sallow hue. The right lung at its base was congested and solid ; and in its upper half there was observed an old cicatrix, near which was an incipient secondary abscess.

Both kidneys contained numerous secondary abscesses in various stages, some of them being very large. The spleen was congested, soft, and friable, and presented

incipient secondary abscesses. All the other organs of the body were found congested, but otherwise healthy.

The wound was much smaller than at first, and was cicatrising at its edges. It was covered with granulations which appeared stagnant.

Remarks.—This case presents an instance of suppurative fever occurring in the course of a diffused and low form of inflammation. It is of especial interest as regards the cause of this disease ; but to this point attention will be drawn in a subsequent part of this work. It may be noted here, however, that in this patient there was a marked absence of all diagnostic symptoms ; while the examination after death showed that very extensive and destructive processes had been going on. No rigors ushered in the fever. He had, it is true, profuse perspiration, a loaded tongue, hurried and somewhat laboured respiration, and the wound was unhealthy ; but he presented no signs of pulmonary disease, and he slept well.

Locally, disinfectant lotions, especially the solution of permanganate of potass, were used ; and the patient's strength was supported as much as possible. Nevertheless he gradually succumbed to the fever.

CASE XIV.—J. D., aged 50, and unmarried, was admitted into hospital on August 3, 1866, with an Abscess on the Dorsum of the Right Foot.

The history the patient gave of her ailment was, that a few weeks prior to admission she noticed swelling, redness, and pain at the metatarsophalangeal joint of her right great toe. This increased, and involved by-and-by the whole dorsum of the foot. Poultices had been applied all over the affected part. She had always

enjoyed good health, and knew of no cause for the present disease. The menstrual discharges were normal. On making further inquiry, it was ascertained that the patient, though well off, was of a miserly disposition, and lived alone, denying herself even the necessaries of life in food, lodging, and clothing. Her chief article of diet had been tea; and in winter she chose to lie shivering in bed rather than have a fire in her room. The constitutional treatment ordered on admission consisted of good diet and a pint of porter daily with tonics. Over the foot poultices were applied. No organic disease was present.

Various abscesses, which formed in the lower part of the leg and around the ankle, were from time to time evacuated. This, along with the afore-mentioned constitutional treatment, produced a marked amendment in the patient's condition. The discharge from the foot was healthy and abundant.

She continued to improve till August 14, when she had a rigor. Her appetite was good. Rigors, followed by profuse perspiration, occurred regularly at mid-day during the ensuing four days. The discharge from the foot was observed to be considerably diminished in quantity, of a bluish-green colour, and fœtid odour.

On the following day the patient's conjunctivæ and skin had a dusky sallow tinge. She had no pulmonary symptoms; and no pneumonia or bronchitis was detectable on making a physical examination of the chest. She ate her food heartily. The same treatment as heretofore was pursued.

Two days later, her conjunctivæ and skin exhibited the characteristic pyæmic colour. Her breath had a sweetish, heavy odour. She complained of pain in the

epigastrium, and said she was afraid "the inflammation was going up her leg." The right leg was very much larger than its fellow, and evidently distended with serum, while the discharge from the foot was small in amount and very unhealthy. The veins of the right thigh were prominent and felt cord-like. On a microscopical examination at this stage of the fever, her blood exhibited a large number of granular bodies like pus corpuscles (between forty and fifty were seen in the field at once); while the red corpuscles were seen to accumulate in masses, but not in roulettes, and seemed to be breaking up into molecules. A similar examination of the discharge from the foot showed the pus corpuscles disintegrating. In addition to the porter which was ordered on admission, she received six ounces of sherry and two eggs daily with her ordinary diet.

Next day the right thigh and leg were found on measurement to be twice as large as the opposite limb; and they pitted on pressure, being distended with serum. On the outer aspects of both thighs were observed phlyctenæ, and purpuric-like patches of a more or less oval form, and each about an inch in length. The patient's pulse was rapid and weak. Her appearance was markedly pyæmic. Her respiration was hurried and laboured; and she was evidently sinking.

She continued to be conscious till her death on the ensuing day. The right foot assumed a gangrenous appearance before death.

Pathological Appearances.—The general condition of the body was healthy. The right lower limb was twice as large as the left one. Both lungs were engorged with blood. The lower half of the right lung

was hepatised, while its upper half was œdematous. There were no signs of pleurisy, nor were any secondary abscesses present in either lung.

The liver had the appearance of fatty degeneration. The spleen was greatly congested and friable; and at one point, of about the size of a pea, the splenic tissue presented indications of secondary abscess formation. Both kidneys were congested.

The right femoral vein was thickened throughout its substance; its lining membrane was congested, and it contained blood mixed with puriform fluid. On dividing both femoral vessels below Poupart's ligament, purulent-looking fluid escaped from their proximal ends. The inguinal lymphatic glands were in a suppurative state; and abscesses were found at various points along the entire length of the right limb in close proximity to the vessels. The tissues within the sheath of the vessels were matted together. The ulcer on the dorsum of the foot, resulting from a superficial slough, had a dark, greenish-coloured margin. None of the neighbouring joints were affected.

Remarks.—A comparatively trifling disease—a small superficial abscess—is seen here to end fatally. Many of the ordinary predisposing causes of suppurative fever were present in this case. The most prominent symptom was despondency—the patient asserting from her admission that she would die. Phlebitis of the affected limb, however, preceded suppurative fever. Her blood was at this time examined microscopically, and it presented certain characteristic appearances which will be more fully referred to hereafter.

The autopsy showed that, though phlebitis was present, sufficient time had not transpired for the develop-

ment of many of the ordinary visceral lesions which characterise suppurative fever.

CASE XV.—On October 26, 1866, the patient, J. H., æt. 51, a farm-labourer, was sent to the hospital from the country, and was said to be suffering from Rheumatic Fever. He was in an extremely weak state, and required to receive brandy before he could be carried upstairs to bed ; and this slight exertion nearly proved too much for his rapidly failing strength. His friends, who accompanied him to the hospital, could furnish no history of his illness, except that the doctor had pronounced the disease to be rheumatism ; and the patient was too weak to give a detailed account of himself. He stated, however, that he had broken his left fore-arm, about fifteen weeks before admission, while working in a field. Seeing he felt no great inconvenience immediately after the injury, he went on using the limb for about ten days, when he was compelled to desist, from the amount of pain at the seat of fracture. He next caught cold, became feverish, and felt pains all over his body, especially in his joints. These he attributed to rheumatism.

On admission the left ulna was found to have sustained a simple fracture, and was bathed in pus. The expression of the patient's face was pinched and anxious ; and he was flushed. His body was emaciated ; his pulse rapid and weak ; his skin hot and dry. He complained of intense pain in all the joints, refusing to allow any of them to be touched or moved. He was so weak as not to be able to speak above a whisper ; and his teeth and gums were coated with sordes. In case the shock of incising the abscess at the seat of

fracture might prove too great for the patient after the fatigue of the journey, this operation was postponed. The forearm was placed on a splint, and poultices applied. Stimulants and abundance of easily digested food, chiefly in the fluid form, were administered.

Two days later, the patient being considerably stronger, the abscess at the seat of fracture, which was as large as a fist, was opened, and a large quantity of foetid, bluish-green pus was evacuated.

The patient exhibited, however, no signs of rallying, and died on November 1.

Pathological Appearances.—Both lungs were found attached to the walls of their pleural cavities by old adhesions. The base of the right lung was pneumonic, and numerous secondary abscesses of various sizes and stages of formation were embedded in the substance of both lungs. In the spleen was observed an incipient abscess. Both kidneys contained numerous purulent deposits of small size. On examining the larger joints, which had been much complained of during life, they exhibited no appreciable pathological changes. At the seat of the injury the ulna was found to have sustained a simple transverse fracture; and the two broken extremities were necrosed, and deprived of periosteum. No callus was present, and there was a distinct interval between the fractured pieces. The soft tissues around the fracture presented a macerated appearance; and their various layers were infiltrated with sanious, foetid pus. No signs of phlebitis were detectable.

Remarks.—This case would favour the supposition held by some distinguished surgeons, that pus enters the blood when an open osseous surface is exposed to

it. In the above case the medullary canal of the ulna was filled with unhealthy pus; and thus a potent exciting cause of suppurative fever was presented. It is interesting to notice that the symptoms were so like those of rheumatism as to lead to an incorrect diagnosis.

Although the disease pursued a very rapid course, very various and extensive pathological lesions were discovered after death. It is very frequently noted in suppurative fever that the pathological changes found after death do not correspond to the symptoms presented during life. In the above instance the symptoms indicated chiefly an affection of the joints; nevertheless, at the autopsy no articular lesions were present.

It is much to be regretted that a more complete history of this case could not have been procured. The accident was a comparatively trifling one; but, having been neglected, it terminated fatally. By the time the patient was admitted into hospital, the disease had advanced too far to allow of any hope of recovery being cherished. That a man may follow a laborious manual occupation with a fractured ulna without experiencing any inconvenience, that a very large abscess may form without giving much pain, and that suppurative fever may be mistaken for rheumatism, are points well illustrated by this case.

CASE XVI.—J. H., aged 57, was admitted into hospital on November 6, 1866, with injuries necessitating primary amputation of his left forearm and leg.

The injuries resulted from the patient being knocked down by a railway engine, which passed over his left hand and foot. When admitted into the infirmary, about two hours after the accident, he was very weak

and anæmic. His pulse was rapid and small, and there was no active hæmorrhage. The patient lost very little blood during the operation, and his pulse was no worse than on admission ; but, being in a very low state, he was allowed to lie on the operating table for about an hour after the operation. During the night he received sixteen ounces of brandy and a pint of strong beef tea, also an opiate on three several occasions during the course of the night.

Next day the patient was better, though he had spent a restless night after a slight attack of diarrhœa. He complained greatly of a frequent desire to go to stool, without passing anything. This was benefited by the use of a suppository containing a grain of morphia and five grains of tannic acid. He had a good appetite, and drank a large amount of strong beef tea during the night. He was ordered "milk diet," with a pint of strong beef tea and two eggs daily. He received also an opiate at bed-time.

November 8.—The dressings were removed from the stumps for the first time this evening ; and the odour exhaled was exceedingly foetid. The stumps themselves looked well. His appetite was good. He slept better. There was no recurrence of the intestinal symptoms.

Two days later the patient was pretty well, and ate his food heartily. He had some frothy expectoration, but no cough. His sclerotics were observed to have a yellowish sallow tinge. Four ounces of wine in addition to the former treatment were prescribed. Slight venous hæmorrhage from the stump of the leg took place at 8 P.M.

November 11.—The patient slept well during the night, and felt better. He experienced a slight rigor

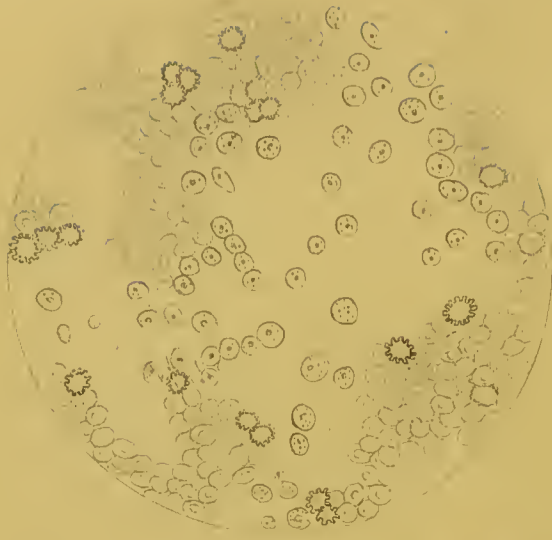
in the forenoon, which was followed by profuse perspiration. His complexion was sallow. He had a little epistaxis. The amount of wine was increased to eight ounces.

November 12.—He slept pretty well, and for the first time without an opiate. The leg stump, which was tense, was opened out and some coagula removed ; thereafter tow soaked in Condyl's fluid was inserted between the flaps. The discharge was thin and grumous, and had a very offensive smell. Some venous hæmorrhage occurred again this morning. Another rigor was experienced during the forenoon. He took his meals with avidity. He was ordered twelve ounces of sherry and four ounces of brandy daily, and an opiate at bed-time.

November 14.—Since last report the patient has complained much of pain in his right shoulder, for the relief of which fomentations were used. There was no redness, swelling, or preternatural heat of the painful shoulder. He had frequently profuse perspirations, and his breath had the usual pyæmic odour. The stumps looked healthy, but the amount of discharge was scanty. In addition to the former treatment the patient received half a pint of porter daily.

November 15.—During the night he was delirious and very restless. He received forty drops of tinctura opii at 2 A.M., after which he slept some time. The first ligature separated to-day. In other respects the patient was much the same as formerly. On microscopical examination his blood was found to coagulate rapidly ; and there were in the field at once about a hundred granular bodies, which, on the addition of dilute acetic acid, presented the usual characters of pus globules. (See Plate I. figs. 1, 2.)

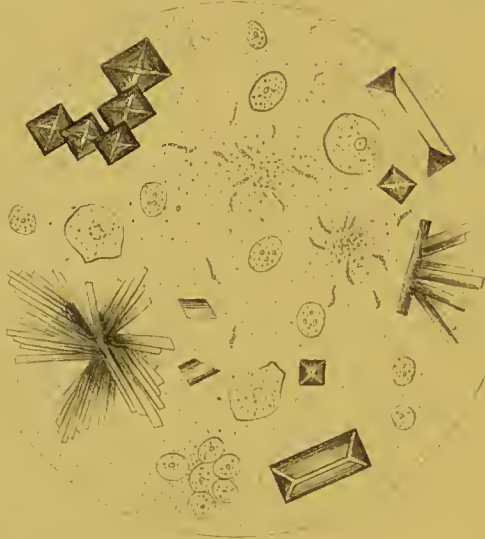
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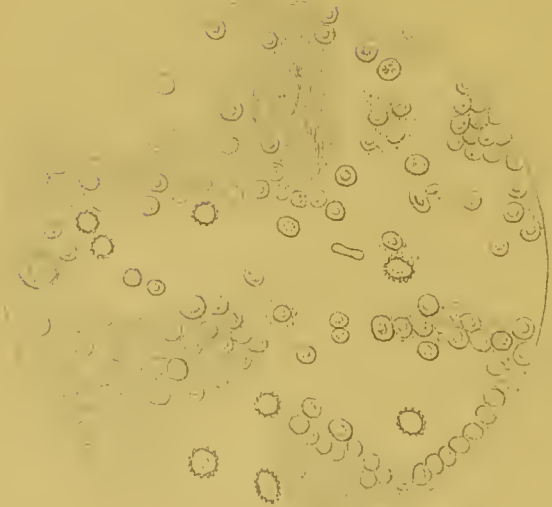
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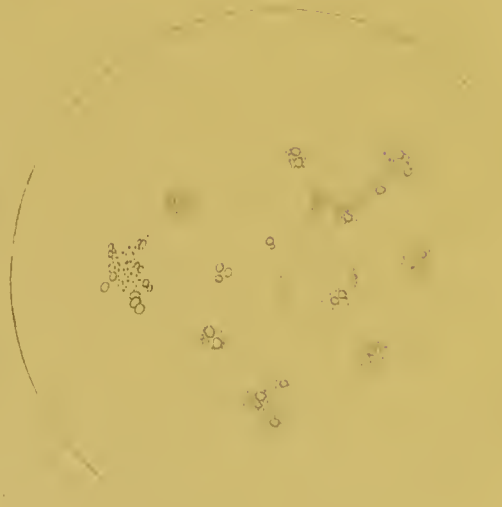
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November 16.—Delirium and restlessness still present. From the leg stump there was a considerable amount of purulent discharge, more than had yet occurred. On sneezing, viscid, purulent matter was discharged from the nose. The shoulder was very painful and slightly swelled. His appetite was very good. His urine was of normal colour, of alkaline reaction, and contained a slight excess of phosphates, also urates, epithelial cells, a few pus corpuscles, vibriones, and granules. (See Plate I. fig. 5.) There was slight sub-sultus tendinum observed during sleep. Respiration was oppressed; sputum was frothy, small in amount, and contained purulent nummuli. He received an opiate at bed-time. The wounds were washed and dressed with tepid water containing Condyl's fluid. Plate I. figs. 3 and 4 represent the appearance of the blood under the microscope on this day, before and after the addition of dilute acetic acid.

November 17.—The patient's condition was much the same as formerly, and he still suffered from profuse perspirations. His appetite was excellent. A small superficial pustule was observed to have formed on the outer aspect of his left thigh. The stumps had healthier appearance. A portion of the margin of the posterior flap of the leg stump had sloughed away. All the ligatures had separated. The discharge was more healthy and more abundant.

November 18.—Delirium and restlessness continued, requiring an opiate to be administered hourly during the night. The discharge from the stumps was very scanty, of a greenish colour and foetid odour. His urine was normal in colour, of alkaline reaction, and deposited urates, phosphates, oxalates, and granules.

On microscopical examination the red corpuscles of the blood were seen to have serrate edges, but showed no tendency to form roulettes ; and no granular bodies were observed in the field.

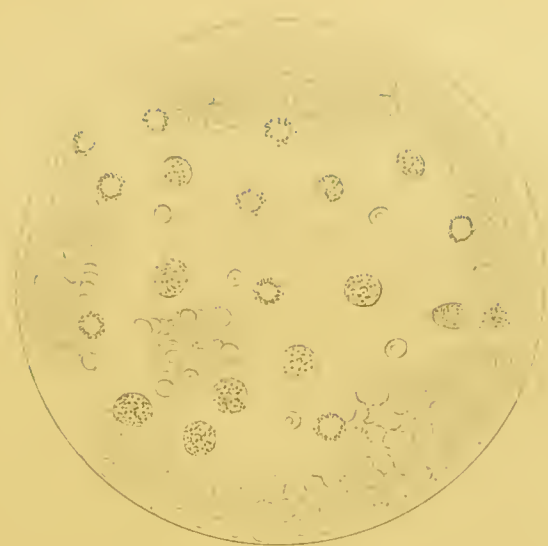
November 19.—The patient slept well, and was less delirious. The amount of discharge was increased. In other respects no alteration had occurred. The red corpuscles of the blood were observed under the microscope to have a tendency to form roulettes, while a few of them presented serrated margins ; and there were some white but no pus corpuscles. (See Plate II. fig. 1.) The patient could scarcely move his right shoulder in consequence of pain and stiffness in the joint.

November 20.—He appeared to be weaker, and there was less discharge from the stumps. He had a good appetite for food, and respiration was not so laboured as formerly. Owing to the patient's helpless condition a physical examination of the chest could not be made. His sputum was considerably increased in quantity, frothy, and mixed with blood. His urine had a straw colour, was of alkaline reaction, and deposited urates, phosphates, oxalates, a few epithelial cells, and numerous granular casts and granules. (See Plate II. fig. 2.)

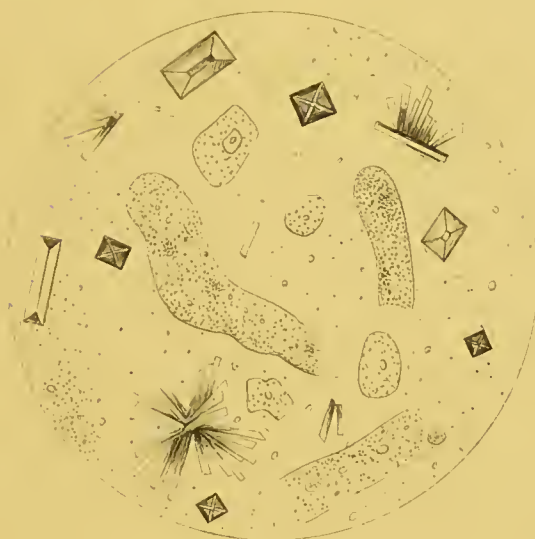
November 21.—During the night the patient did not sleep soundly, but he had no delirium. No abnormal signs were observed on percussion and auscultation of his chest. Pulmonary tissue was detected in the sputum on microscopic examination. (See Plate II. fig. 3.) He still suffered from profuse perspirations, and his body was covered with sudamina.

November 22.—Respiration was hurried and laboured. He had muttering delirium during the day, and at intervals was unable to recognise those around him.

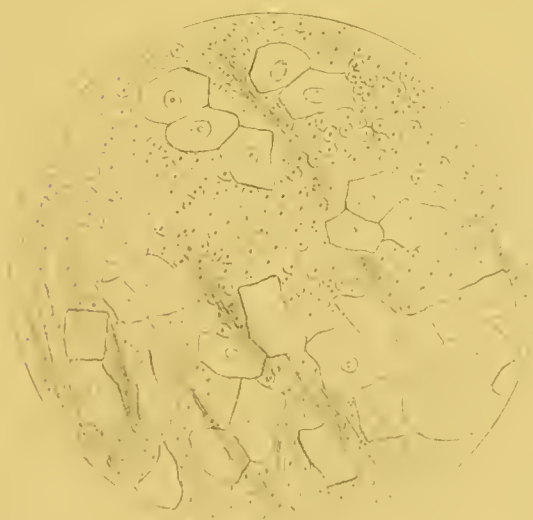
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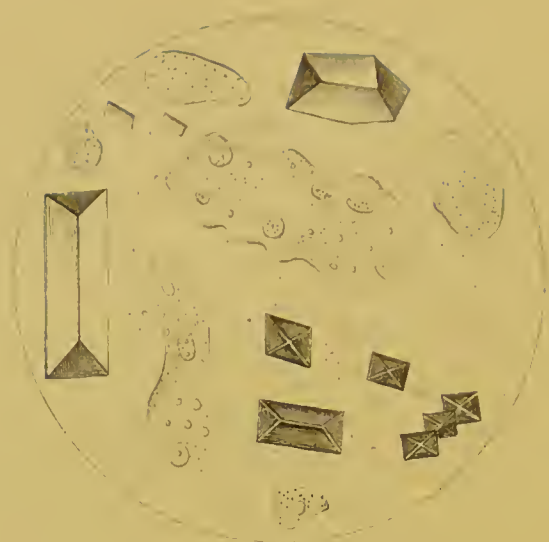
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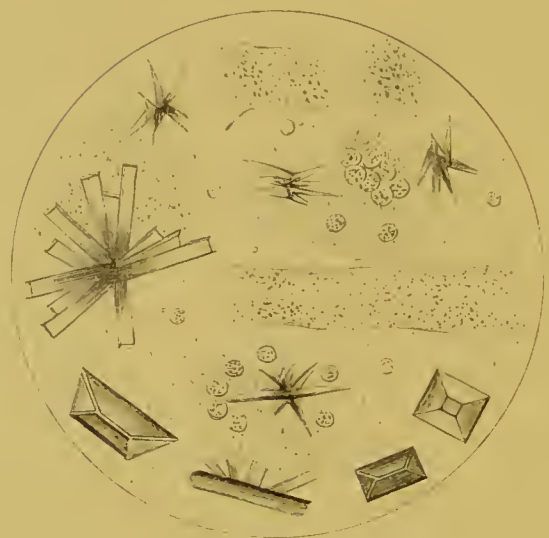
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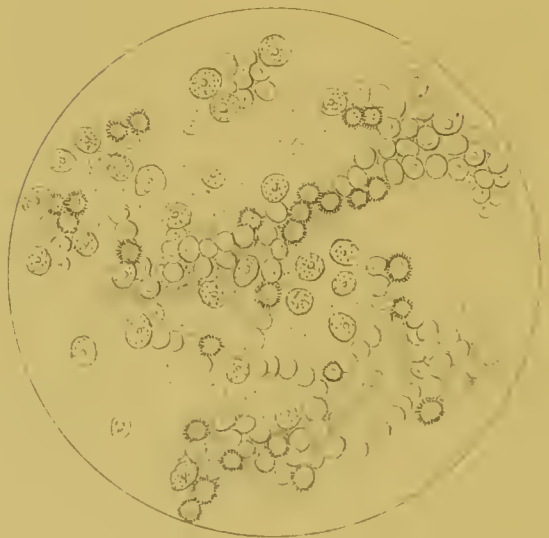
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He had epistaxis from the left naris. He seemed to be very weak. There was more discharge from the stumps. The treatment all along consisted in a free exhibition of stimulants, of nourishing and easily-digestible food, and of tonics, while locally disinfectant lotions were employed.

November 23.—He spent a wakeful night. His right shoulder was quite immobile, and very painful when the finger was pressed over the acromion process and back of the joint; but there was no fluctuation to be felt. His urine contained a deposit represented in Plate III. fig. 1.

November 24.—He slept better, and ate heartily. He had no cough, and his expectoration was increased in quantity, viscid, and purulent. The urine was normal in colour, of alkaline reaction, and contained phosphates, a few oxalates and granules, but no casts.

November 27.—The patient was very low, and was at times only partially conscious. He suffered from very profuse perspiration. Respiration was laboured and hurried; and his sputum was occasionally interspersed with blood. He had slight rigors.

November 28.—He vomited all his dinner. He was much depressed.

November 29.—He slept well, but his appetite was impaired. The discharge from the leg stump was noticed to be scanty and sanious, and the granulations were flabby. The forearm stump had quite cicatrized.

November 30.—He had great thirst, but a better appetite. His urine was slightly acid, and deposited urates, phosphates, granules, pus corpuscles, and granular casts. (See Plate III. fig. 2.)

December 2.—In most respects no alteration in the

patient's condition had occurred. On microscopical examination his blood was found to be very coagulable; the red corpuscles, congregating in groups, but not forming roulettes, presented serrated edges, and enclosed numerous granular bodies like pus corpuscles, of which sometimes above sixty were seen in the field at once. (See Plate III. fig. 3.) His respirations were fourteen per minute and laboured.

December 3.—The patient was in much the same state as formerly. His urine on examination was found to give an alkaline reaction. It had a dark claret colour, and deposited a flocculent sediment containing broken down epithelial cells and granules.

December 5.—His appetite for food continued good, and he slept well. He still suffered from profuse perspirations, and complained greatly of thirst.

December 7.—Fluctuation was felt in the right shoulder-joint; and, on making an incision in this region, a large amount of greenish foetid pus was evacuated. A portion of Chassagniac's drainage tubing was inserted into the wound.

December 8.—The patient had delirium during the night. His urine was acid, and deposited urates and phosphates. The sputum expectorated was of small amount, viscid, and rust-coloured.

December 10.—He slept better and ate more heartily. The cutting pain in the right third intercostal space, which was complained of yesterday, was absent to-day. On moving the right arm a grating sensation was detected in the right shoulder-joint. There was a very large amount of unhealthy, bluish-green, extremely foetid discharge from the right shoulder and arm; but the leg stump was almost dry.

TABLE OF THE PULSE AND TEMPERATURE.

Date.		Pulse.	Temperature.
November	7	90 and of fair strength,	(Fahrenheit.)
"	12, Vesp.	120 . . .	100°
"	13	112 . . .	100
"	" Vesp.	110 . . .	97
"	14	120 . . .	102
"	" Vesp.	120 . . .	97
"	15	124 and weak,	100
"	" Vesp.	120 . . .	95
"	16	130 . . .	91
"	" Vesp.	116 . . .	95
"	17	122, weak and compressible,	102
"	" Vesp.	120 . . .	100
"	18	118 . . .	95
"	" Vesp.	112 . . .	99
"	19	114 and very weak,	95
"	" Vesp.	116 . . .	98
"	20	120 . . .	98
"	" Vesp.	112 . . .	97
"	21	116, very small and com- pressible,	} 97
"	" Vesp.	114 . . .	
"	22	121 and very weak,	95
"	" Vesp.	120 . . .	98
"	23	120 . . .	100
"	" Vesp.	124 . . .	97·6
"	24	122 . . .	101
"	25	120 and very weak,	100
"	26	112 . . .	100
"	" Vesp.	120 . . .	101
"	27	116 . . .	100
"	" Vesp.	122 . . .	101
"	28	116 . . .	100
"	" Vesp.	114 . . .	99
"	29	120 . . .	96
"	" Vesp.	120 . . .	100
"	30	116 . . .	99
December	1	124 . . .	100
"	" Vesp.	106 . . .	101
"	2	120 . . .	100·2
"	" Vesp.	110 . . .	100
"	3	120 . . .	102
"	" Vesp.	116 . . .	100·2
"	4	114 . . .	100

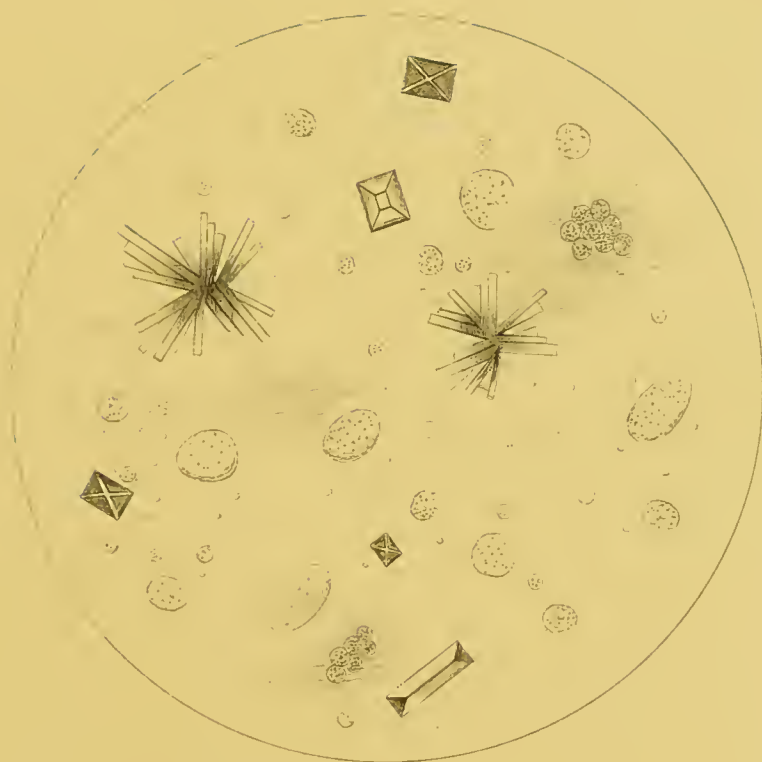
TABLE OF THE PULSE AND TEMPERATURE—*continued*.

Date.		Pulse.			Temperature.
December	4, Vesp.	114	.	.	98·1
"	6	116	.	.	100
"	7, Vesp.	116	.	.	100·2
"	8 "	116	.	.	99
"	9	128	.	.	102
"	" Vesp.	114	.	.	101·1
"	10 "	116	.	.	97
"	11 "	114	.	.	97·2
"	13 "	130 and very weak,			101
"	14	124	.	.	97
"	" Vesp.	122	.	.	99·1
"	15	124	.	.	99
"	16	130	.	.	100
"	" Vesp.	120	.	.	96
"	17	124	.	.	101·2
"	" Vesp.	130	.	.	100
"	18	122	.	.	99·2
"	" Vesp.	122	.	.	101
"	19 "	130 and very weak,			100
"	20 "	132, weak and compressible,			100·2
"	21 "	128	.	.	101
"	22 "	126	.	.	101
"	23 "	134	.	.	101
"	24 "	132 and very small,			103

December 11.—The patient did not sleep much during the night, and was purged several times. The diarrhoea was checked by the use of a suppository containing five grains of tannic acid and half a grain of morphia. A copious discharge still poured out of the right shoulder-joint and the inner aspect of the arm along which it burrowed.

December 12.—His features were observed to be sharp, and he appeared to be sinking. His urine was of normal colour, of alkaline reaction, and contained urates, phosphates, a few oxalates, pus corpuscles, and very large round or oval granular bodies. (See Plate IV.)

December 13.—His symptoms were the same as



yesterday, but aggravated. His sputum was copious, viscid, and tenacious, rusty, and contained numerous purulent masses. He had some diarrhœa, which was arrested by the employment of a suppository containing a grain of morphia.

December 14.—The patient slept pretty well after receiving an opiate. He still suffered from profuse perspirations, but his appetite was improved. The discharge from the right shoulder-joint was large in amount, very foetid, and of thicker consistence. The same treatment as formerly, including the administration of quinine, was pursued.

December 16.—He was much emaciated, and ate little. In other respects his condition had not altered. His urine was normal in colour, of alkaline reaction, and deposited phosphates, urates, oval and round epithelial cells and granules.

December 17.—He slept badly, though he received an opiate. The discharge from the right shoulder-joint was less in amount and more sanious. He still suffered from profuse perspirations. He received eight ounces of brandy and six ounces of wine daily.

December 20.—He had diarrhœa, which was checked by the same remedies as formerly ; he had also vomiting. His urine presented the same characters as when examined on the 16th inst.

December 22.—The patient was evidently sinking. He was restless, talkative, and delirious during the night. He had a rigor about 6 A.M. The discharge from the shoulder was large in amount and less foetid than formerly. The leg stump had cicatrized completely round the projecting spine of the tibia.

December 23.—He continued to be much in the

same state. He perspired profusely and ate little. Towards evening he passed into a state of constant muttering delirium.

December 24.—He was more delirious, and evidently sinking fast. There was a scanty amount of discharge from the shoulder-joint. He exhibited well-marked subsultus tendinum. He died at 6 A.M. of the following morning.

Pathological Appearances.—The body was greatly emaciated. The blood was fluid.

On opening the cranium the veins of the dura mater were observed to be congested. A considerable amount of serous fluid was present in the subarachnoid space and in the lateral ventricles. The brain was of healthy consistence, but its grey matter was paler than natural.

On removing the right shoulder-joint its soft tissues were found to be altogether disorganised, and the head of the humerus was carious. A portion of the articular cartilage of the head of the humerus was observed to be ulcerated away. The soft tissues of the right arm were softened, and of a greenish sloughy appearance. On section of the axillary vessels no blood escaped; and they appeared to be healthy. The femoral vessels also looked healthy. No laceration of the capsule of the left (dislocated) shoulder-joint was detected.

On examining the thorax the heart was found healthy. Both lungs were firmly adherent at their apices, congested in their lower halves, and studded near their bases posteriorly with whitish spots of the size of pins' heads, firm to the touch, and elevated, resembling miliary tubercle. As these spots were for the most part in the immediate neighbourhood of veins, they suggested the idea of being "embolia." Near the

centre of the right lung was a large bridge-like cicatrix, and also several superficial whitish patches—probably old pleuritic adhesions.

The liver was normal. The spleen was congested; but in other respects it appeared to be healthy. The large intestine was congested for about six inches near the centre of its track. The kidneys were healthy in appearance.

Sudamina were abundantly distributed over the face and front of the chest.

Remarks.—This is a case deserving careful study. As regards the symptoms exhibited, the course pursued by the fever, the treatment employed, and (to a certain extent) the lesions discovered after death, no better example of suppurative fever could be found. It is on this account that I have narrated this case in such detail, carefully recording the symptoms at short intervals, and inserting the repeated microscopical examinations of the blood and urine which I made. The accompanying drawings were taken at the time and elaborated at a later date.

It will be noted in the first place, then, that the symptoms of suppurative fever set in soon after amputation, and indicated the subacute variety of this disease. The patient at an early date exhibited signs of great debility. His appetite, however, remained unimpaired till nearly the close of life. Distinct pulmonary symptoms were never developed. Both stumps healed quickly, as if his health had been unaffected. The patient's strength, on the other hand, was at intervals reduced by diarrhœa. He suffered from profuse perspirations and occasional delirium. He remained thus for weeks on the brink of the grave, and the balance wavered.

The commencement and progress of the articular affection in this case well exemplifies the course of this not uncommon complication of suppurative fever. Pain and stiffness were during several days the only symptoms, and then the joint became suddenly swollen. When incised, a very large quantity of greenish, foetid pus escaped ; and this large amount continued to form till within a short time before death.

Regarding the treatment of this patient, it may be remarked that quinine was beneficial only by reason of its tonic properties. The patient received also abundance of stimulants and of nourishing and easily-digested food. The wounds were washed and dressed twice daily with tepid water containing Condyl's fluid. This added to the patient's comfort, though it did not cut short the disease.

Lastly, it was observed at the autopsy that, considering the long duration of the fever, the pathological lesions were comparatively trifling, or rather, that they characterised an incipient stage of the disorder. It must strike even the most casual student of the preceding case, that the visceral changes discovered on the post-mortem table did not correspond with the symptoms observed during life. The kidneys, for example, appeared to be healthy, though the urine during life indicated that the renal tissue was involved in the suppurative process. In short, though the fever progressed slowly, and thus abundance of time existed for the development of secondary abscesses in the viscera, comparatively few purulent deposits were found in the internal organs after death ; and these abscesses were in the incipient stage.

CASE XVII.—W. S., aged 12 years, was admitted into hospital on June 30, 1865, on account of disease of the left shoulder-joint.

The patient was a delicate-looking boy, and the disease had been of six months' duration. The symptoms, characteristic of the articular affection, were plainly marked. Accordingly, the joint was excised on July 5 by the simple longitudinal incision method.

During the night after the operation the patient slept soundly, and was next day as well as could be looked for. There was a slight redness of the integument round the wound.

On the afternoon of the fourth day after the operation the patient had a rigor. There was no premonitory constitutional disturbance, and the wound looked healthy, discharging freely.

Two days later he was troubled with flatulence, which distended the abdomen so much as to render respiration difficult. This was relieved by carminatives.

The patient progressed favourably from this time forward till July 14, when he experienced another rigor, followed by profuse perspiration, and by mental depression. His appetite was good. The wound continued to discharge a large quantity of well-formed pus, and had a healthy appearance. The erythematous blush had almost entirely faded away. The treatment consisted in the administration of nourishing and easily-digested food, with a little wine; and in the use of lotions, along with strict attention to cleanliness in dressing the wound.

Three days later (July 17) another rigor occurred; and pain in the inner aspect of the lower part of the arm was complained of.

The patient did not sleep well ; and on July 18 the left forearm and lower part of the arm were observed to be much swollen.

On July 19 he complained of cough ; but a careful examination of the chest by percussion and auscultation detected nothing abnormal. On making an incision on the outer aspect of the lower part of the arm, a considerable amount of unhealthy, foetid pus was evacuated. He had another rigor on this day.

July 20.—He was restless and somewhat delirious during the night, but in other respects his condition had not altered.

July 21.—A rigor occurred during the night, and another during the course of the afternoon. His breath was observed to have a sweetish, hay-like odour. His respiration was hurried and laboured. He was also very delirious. The wound looked healthy, and discharged freely. The same treatment as formerly was employed.

On the following day he was very feverish, and still delirious. His appetite for food was good, and there were no marked pulmonary symptoms.

Two days thereafter the patient experienced a severe rigor, followed by profuse perspiration, and he continued to be delirious.

On July 25 he was still delirious, and had a cough accompanied by the expectoration of rusty sputum containing purulent nummuli. Loud crepitant râles were heard on auscultation over the lower half of the right lung ; and percussion elicited a dull sound in this region.

July 27.—The patient's state was much the same as in the last report, but there was superadded spasmodic

twitching of the muscles of the affected arm and of the face.

On July 28 there was more delirium. His cough was very troublesome, and accompanied by the expectoration of frothy and purulent sputum. He ate his meals heartily, and slept well. There was a large quantity of discharge from the wound. The treatment consisted in the administration of nourishing food and stimulants, while poultices were applied constantly to the back of the chest and over the abscess of the arm.

Two days later another large abscess was opened near the middle of the arm. The patient had a good appetite for food, and slept pretty well; but he was losing flesh rapidly.

On August 3 another abscess, which had formed over the left coracoid process, was evacuated. The pus was unhealthy and in large quantity. His cough was better; and the expectoration was almost entirely bronchitic in character.

From this date onwards convalescence was uninterrupted. His pulse continued to be very rapid, but became stronger and fuller. The pulmonary symptoms gradually passed off; and the discharge from the abscesses diminished.

On August 8 another abscess was opened on the back of the lower part of the left arm. The patient's appetite for food improved thereafter, and he gained strength daily.

A bed-sore, of the size of a half-crown piece, was discovered on August 14, over his sacrum. He was in very weak state, but was steadily improving.

On August 22 a deep-seated abscess on the left side

of his face was opened. He was ordered to take ten drops of the tinctura ferri muriatis three times daily.

The patient was dismissed well on September 10. He experienced little or no pain on using his left arm. His general health was good. A small amount of discharge flowed from the wound made for the removal of the joint, but all the other incisions were healed.

TABLE OF THE PULSE.

Date.	Pulse.	Date.	Pulse.
July 6	110	July 25	98
" " Vesp.	96	" 26	88
" 7	92	" 27	86
" 9	90	" 28	100
" 10	94	" 30	104 and
" 11	88		weak.
" 12	92	Aug. 1	108
" 14	100 and	" 3	110
	weak.	" 5	120
" 16	94	" 7	126
" 17	96	" 9	116
" 18	88	" 11	128
" 19	86	" 13	122
" 20	100 and	" 14	118
	weak	" 16	114
" 21	86	" 18	118
" 23	100	" 20	114
" 24	108 and	" 22	120
	weak.	" 24	120

Remarks.—No one will question, surely, that this was a case of suppurative fever. The pyæmic colour of the skin, the purulent odour of the breath, the unhealthy character of the discharge, profuse perspirations, and—most characteristic symptom of all—the formation of consecutive subcutaneous abscesses in different localities, were all present in this instance.

The suppurative fever was, moreover, in this case complicated by pleuropneumonia, which ran its usual course. Recovery was most satisfactory, as the suppurative fever left no traces.

In the treatment of this patient the rule observed was to support the constitution, not to endeavour to cut short the disease.

CASE XVIII.—C. M., aged 14, was admitted on May 3, 1865, with Disease of the Left Tarsus. This affection commenced six months previously with swelling, pain, and redness round the left ankle-joint; and it was ascribed to wearing tight boots. When examined on admission into hospital, the left foot was observed to be swollen, and there was slight pain on pressure over the tarsus, especially over the internal cuneiform bone. Great pain was felt on bringing the articular surfaces into contact, but there was no crepitus nor any sinuses.

Syme's amputation was performed six days later, and the joint was found to be extensively diseased. The patient received an opiate after the operation, and then had some sleep. During the course of the evening a little venous oozing, but no reactionary hæmorrhage, occurred.

On the following day, though he had slept pretty well, the patient's face was flushed, and his skin was hot and dry.

Two days later the left leg showed an erysipelatous blush, for the relief of which fomentations were used. He required an opiate at night. His appetite for food was much impaired, and his tongue loaded. Stimulants were prescribed, and the wound was dressed with tepid water containing Condyl's fluid.

About 11 A.M. of May 14 venous hæmorrhage and rigors occurred. Heat of the surface of the body, perspiration, vomiting, and purging followed. A few hours later the patient complained of a sharp cutting pain in the lower part of the chest. The stump looked well, and the ligatures had all separated.

Next day rigors were again experienced about 11 A. M. He had a severe pain referred to the epigastrium and to the lower half of the right lung. His tongue was dry. The wound had a sloughy appearance, and poured out large quantities of extremely foetid sanious discharge. A charcoal poultice was applied over the stump. At the evening dressing the wound looked better, and the discharge was less offensive.

At 7 P.M., of the following day, hæmorrhage took place, requiring the stump to be opened out. One vessel was ligatured, and an exfoliation from the tibia was removed. The soft tissues of the leg, for about two inches above the wound, were in a sloughing state. The patient's condition seemed to be improved next day; but on May 19 the wound again looked very unhealthy, and there was a large amount of discharge from the stump. The conjunctivæ and skin began to assume the characteristic dusky-yellow tinge.

On May 20 it was reported that the wound looked better and the discharge more healthy. During the night the patient was very restless and delirious. The pain in the thorax, and the cough, continued to be much the same as formerly; and his appetite for food was very much impaired.

Next day another rigor was experienced. The delirium was worse, but there were conscious intervals.

The stump "looked much better." An opiate at bed-time was still administered.

An abscess situated over the left zygoma was opened on May 22. His urine was normal. His sputum was scanty in amount and purulent. He had no pain, and only a slight cough.

The patient died delirious on May 23.

TABLE OF THE PULSE.

Date.	Pulse.	Date.	Pulse.
May 9, Vesp.	114 and strong.	May 15 Vesp.	90
" 10	94	" 16	82
" " Vesp.	112	" 17	88
" 11	86	" 18	84
" 12	115	" 19	96
" 13	110	" " Vesp.	110
" 14	88, weak and compressible.	" 20	108
" 15	100, weak and irregular.	" 21	102
		" 22	96
		" 23	90

Pathological Appearances.—At the autopsy, held on May 27, a circumscribed abscess was found in the immediate neighbourhood of the left meningeal veins.

On opening the thorax the bases of both lungs were observed to be eongested; and there were numerous secondary abscesses of various sizes and in various stages of development, in the upper two-thirds of both lungs. About the centre of the left lung was situated a metastatic abscess, one and a half inch long and three-quarters of an inch broad, the contents of which were foetid pus and broken down lung substance. The rest of this lung was œdematous.

The liver was soft and flabby, seemingly fatty, and contained no secondary abscesses. The spleen was of

moderate size, soft, and contained near its lower end a single metastatic abscess. The kidneys presented the ordinary appearances of cloudy swelling. All the other viscera were healthy.

On examining the stump, the tibia was found soft in its centre, and contained purulent fluid throughout nearly eight inches of its extent. The fibula was diseased for about two inches. Abscesses were met with among the soft tissues of the leg along nearly half its length; and one was discovered in close proximity to the posterior tibial vein, about four inches from its lower orifice. The vein, as far as this point, was firm, of a greenish colour, with purulent infiltration upon its internal surface and among its coats. The extremity of the stump looked sloughy, and the ends of the bones were necrosed.

Remarks.—Here we have an instance of suppurative fever following one of the safest of the major amputations. The first rigors were experienced on the fifth day after amputation, and were almost immediately followed by pneumonic symptoms. The rigors recurred at intervals; venous oozing and hæmorrhage took place; secondary subcutaneous abscesses formed, and were opened; and a portion of the tibia exfoliated. The typhoid stage set in on the sixth day after the commencement of the fever, and ended in death three days later.

Regarding the symptoms present in this instance, it will be remarked that there was absence of the profuse perspirations so characteristic of suppurative fever, and that the pyæmic tinge was not so well pronounced as it sometimes is.

The autopsy in this case was particularly interesting. The secondary abscess formation was very diffuse, and

could not have been diagnosed by the symptoms exhibited during life. Most worthy of note among the pathological lesions was the condition of the bones of the stump, which resembled, more than any other instance I have met with, the osteomyelitis described by Professor Fayrer. Almost the whole extent of the medullary canal of the tibia, and nearly half that of the fibula, were softened, honey-combed, and at intervals broken down so as to form distinct abscesses.

CASE XIX.—W. P., aged 31, was admitted into hospital on January 14, 1865, with Internal Hæmorrhoids.

The patient stated that he had suffered from this affection for seven years, and that he had been operated on for it on two previous occasions. The hæmorrhoids had lately bled much, so that he was weak and anæmic.

The hæmorrhoids were ligatured on January 14, after the bowels had been opened by an enema. The operation was performed without chloroform. One of the hæmorrhoids had a pretty large ulcerated surface.

On January 16 (two days subsequently) the patient had rigors, which recurred at short intervals till January 18, when he complained of pain in the left side of the thorax. Sinapisms were applied over the chest, and an opiate administered at night.

On January 20 he was much worse. His pulse was 140 and very weak. His skin presented an ashy-yellow colour. He was delirious and restless at night, notwithstanding the use of opiates. On auscultation a friction sound was heard over the lower part of the left side of the thorax, and a blister was applied to this region. To relieve the uneasiness caused by the ligatured hæmorrhoids a poultice was twice daily applied to the perineum.

The patient passed a very bad night, and next day he was very low. His lips were parched and his tongue dry. He was very thirsty and ate little food. A careful physical examination of his chest was made, when it was discovered that he had pleuropneumonia of the base of his left lung. Respiration was hurried and painful. He suffered also from profuse perspirations. He was ordered large quantities of brandy, ice, and potassæ chloras in the form of a drink. The hæmorrhoids separated on the eighth day after the operation.

On January 26 the patient lay sunk down in bed, but was less delirious. His pulse was 108 and stronger. He complained of less pain on coughing. His appearance and condition were unmistakably those of suppurative fever.

Next day his pulse was 110. He ate no food. He was conscious, but too weak to answer questions. He died during the course of the afternoon.

Unfortunately a post-mortem examination was refused by the deceased's relations.

Remarks.—The comparatively safe operation of the ligature of varicose veins, we observe, is sometimes followed by suppurative fever.

The symptoms presented by this case were, I think, sufficiently pathognomonic. It would have been interesting, however, to have discovered at an autopsy the extent of the secondary purulent deposits. The first rigor was experienced so early as the second day after the operation; the inflammatory process necessary for the separation of the ligatured hæmorrhoids pursued its normal course; but on the sixth day after the operation symptoms of pleuropneumonia were developed. From

this time the patient became worse and worse. A typhoid state, characterised by delirium, followed; and he died on the thirteenth day after the operation. Although the formation of subcutaneous secondary abscesses did not take place in this instance, most of the other symptoms of suppurative fever were present. The case was one of systemic infection rather than of a typhoid form of pneumonia. When we have not the evidence of a post-mortem examination in cases of suppurative fever, we ought to form our diagnosis on the collective symptoms presented, not trusting to any *one* symptom. As in other fevers the most pathognomonic sign is often absent, so we meet with many examples of suppurative fever in which subcutaneous purulent deposits or affections of the joints are not developed.

CASE XX.—A Danish sailor, R. H., æt. 19, was admitted into hospital on April 26, with Acute Necrosis of the left Femur extending into the knee-joint.

The history of the case, as obtained through the medium of German (with which language the patient was not thoroughly conversant), was the following. While at sea, between three and four weeks before admission, the patient observed his left knee to be swollen, and he felt pain in its upper and inner part. He knew of no exciting cause, and these symptoms were not preceded by rigors. In a few days his left thigh became swollen and painful. Without attending to these symptoms, the patient went about his work till a week before admission, when he took to bed. His appetite for food and his general health were good; and the articular pain was of equal severity by night and

by day. Soon after the commencement of his illness he consulted a Norwegian surgeon, who prescribed an ointment which discoloured the skin and did not benefit him.

On admission, the left knee-joint was greatly swelled and very painful, and fluctuation was felt below the patella. The thigh was twice its normal size and very tender on pressure, especially in its lower third, where deep-seated fluctuation was felt. The left ankle and foot were œdematous. He was very weak, but he exhibited no symptoms of organic visceral disease. Hot fomentations were applied over the affected joint, and the limb was kept elevated.

By the use of these means the œdema disappeared in a few days, but the size of the thigh and of the joint had not diminished. His appetite and general health were improved, and he suffered little pain.

On May 1 the patient's constitutional state was much better; but behind the diseased knee there was a sudden increase of swelling and distinct fluctuation to be felt. An incision was, accordingly, made into the sheath of muscles on the outer aspect of the thigh, just above the knee-joint, and this evacuated a large quantity of pus and of venous blood. Amputation through the lower third of the thigh was performed at once, as it was evident that the popliteal vein had given way. After sawing through the femur at the usual point, it was found to be still further diseased; and more of the bone was removed. Suppuration was found extending along the thigh close to the femur above the point where it had been divided last. No reactionary hæmorrhage occurred. On dissection, a small ulcerated opening was discovered on the outer aspect of the

popliteal vein, and the tissues of the popliteal sheath were found thickened and matted together. The medullary structure of the femur was disintegrated, and macerated by unhealthy and very foetid pus.

The patient improved daily after the operation. He gained flesh and was in good spirits. The stump healed well, and the discharge from it was healthy and profuse. The treatment consisted of nourishing diet, with tonics and large quantities of wine and brandy. Occasionally an opiate was given at night. The ligatures separated at the normal period.

On May 11 the patient was observed to have a bed-sore.

He had a rigor two days later, and next day the wound looked sluggish and discharged less. Rigors occurred daily, and were followed by pyrexia.

On May 16 his face was flushed, and his appetite for food was impaired. His lips were parched. He had slight cough. The discharge from the stump was scanty in amount.

On the ensuing day the patient became very delirious, and tossed about. Although he had received an opiate at bed-time he had been very restless during the night. His tongue was dry and brown, and his teeth covered with sordes. The dusky-yellow pyæmic tinge was well developed, and his breath had a sweet and hay-like odour. The wound was sloughy and sluggish, discharging a scanty amount of bluish-green and very foetid pus.

He died on the evening of the following day.

Pathological Appearances.—The body exhibited the characteristic dusky-yellow hue of suppurative fever.

On opening the thorax its cavities were found to contain a considerable amount of seropurulent fluid ;

but there was a smaller quantity of it on the right than on the left side. Both layers of the pleuræ on either side were covered with lymph at their lower part; and both lungs contained numerous secondary abscesses in all stages of development. The lower part of the left lung was firmly adherent through old pleuritic exudation. There was some yellowish serum in the pericardial cavity, and firm coagula in the heart. *

TABLE OF THE PULSE.

Date.	Pulse.	Date.	Pulse.
On admission.	90 and of	May 9	90
	fairstrength.	" 10	88
April 30	108	" " Vesp.	112 and
May 1	96		very weak.
" " Vesp.	112	" 11	100
" 2	96	" 12	86
" 3	96	" 14	104
" 4	90	" 15	94
" 5	92	" " Vesp.	100
" 6	100	" 16	102
" 7	118	" " Vesp.	100
" " Vesp.	96	" 17	132 and
" 8	100		scarcely per-
" " Vesp.	90		ceptible.

The liver was somewhat enlarged, but not discoloured. There were several spots of extravasation distributed through the hepatic substance. The spleen was larger than normal, pulpy, and contained pigment. The kidneys were somewhat flabby. No secondary abscesses were found in the abdomen.

On dissecting the stump, the periosteum, as far as the lesser trochanter, was greatly thickened. The end of the femur was necrosed. Secondary abscesses, containing greenish foetid pus, were observed in close proximity to the blood-vessels along about half the length of the

thigh ; but they did not communicate with the blood-vessels.

Remarks.—There are many note-worthy points presented by this case. The primary disease was evidently acute necrosis of the femur, which soon involved the neighbouring knee-joint. For some days after the patient's admission into hospital he improved greatly, till a sudden swelling behind the knee-joint led to the suspicion of hæmorrhage taking place among the deep-seated soft tissues of the limb. An exploratory incision proved the surmise to be correct ; and dissection after amputation revealed an ulcerated orifice on the outer aspect of the popliteal vein communicating with the interior of that vessel. This lesion is of interest on account of its rarity, but still more so when viewed in relation to the origin of suppurative fever. The osteomyelitis of the femur, present in this instance, leads to the inquiry, whether the suppurative fever which followed is to be ascribed to the introduction into the system of morbid matter through the vein, or to its imbibition by the medulla of the bone, or to both combined. The ordinary sequence of phlebitis to osteomyelitis was not observed in this case ; and the symptoms exhibited lead rather to the conclusion that these forms of unhealthy inflammation were not the sources of systemic infection. Even though the limb was amputated, the untoward sequela of suppurative fever supervened, confirming my remarks on Professor Fayrer's proposal of curing pyæmia by amputation, to be found in a subsequent chapter, under the title of the "Treatment of Suppurative Fever."

CHAPTER IV.

SYMPTOMATOLOGY OF SUPPURATIVE FEVER.

LIKE most non-contagious fevers, suppurative fever presents a chronic and an acute form. Chronic pyæmia is most commonly met with in connection with such medical affections as typhus and scarlet fever, empyema, rheumatism, dysentery, &c.; while acute pyæmia generally succeeds surgical operations and injuries, and parturition.

Examining carefully the symptoms presented by these two forms of the disease, they meet us as general and local phenomena. The constitutional or general symptoms which characterise suppurative fever in its acute form, or as a consequence of surgical wounds and affections, are best considered analytically, as follows:—

The Physiognomy.—The face is often flushed. This flushing is general and of a reddish hue; sometimes there is great pallor, and sometimes alternate flushing and pallor. The countenance is anxious; but there is no particular characteristic expression, like that in peritonitis or apnœa. Occasionally the patient is depressed—he anticipates from the very outset of the disease a fatal issue. As the fever progresses the features become pinched, haggard, and care-worn. During sleep

the eye-lids are partially separated, the eye-balls are turned upwards, and the corneæ become dull and dry ; or a hazy-looking film spreads over them. The eyes seem dull and sunken towards the close of the disease. By-and-by the conjunctivæ and skin of the face acquire the dusky, sallow, icteric tinge which is afterwards observable on the rest of the body. The nostrils sometimes become dry, and their internal surface is covered with a brown crust composed of the inspissated normal secretion. As death approaches, the gums and teeth are covered with sordes, and the lips become livid.

These symptoms are always more or less pronounced ; but they cannot be regarded as pathognomonic, seeing they accompany the typhoid state of other diseases.

Morbid Appearances of the Skin.—The “dusky,” “sallow,” “leaden,” or “icteric” tinge of the skin over the surface of the body is one of the most marked features of this disease. Resembling sometimes the coloration which is met with in diseases of a general typhoid type, the characteristic hue of suppurative fever differs in having a yellowish tinge intermixed with the dull-leaden or ashy colour which accompanies wasting disease. After being once or twice carefully observed, it is readily recognised and distinguished from the mere sallowness of cachexia and from the more golden colour of true icterus.

In Case XVI. a careful record of the temperature was kept during the whole course of the fever, nearly six weeks. It was registered for the most part twice daily, at mid-day and at midnight. There is not much variation to be observed during this long period, nor is there any relation traceable between the variations in the pulse and those of the temperature of the skin.

Often after the premonitory rigor there are dryness and increased temperature of the surface of the body, which last for a longer or shorter time. This condition is followed by profuse, cold perspirations. The perspirations which accompany this disease are most profuse, like those of advanced phthisis. They never precede the rigors, but may occur independently of them. They either are continuous in their duration, or exhibit more or less distinct exacerbations. They are occasionally accompanied by sudamina (as in Case XVI.); and they do not abate with the use of any known remedy. The sudamina are sometimes surrounded by a zone of congestion (says Bristowe*), which, by the careless observer, may be mistaken for the spots of typhus or of enteric fever. Occasionally (according to Callander†) perspiration is scanty; but, before death, a cold, clammy sweat, and a “tawny” discoloration of the skin occur.

In some instances (as in Case XIV.) phlyctenæ and purpuric patches become developed during the progress of suppurative fever; and (as in Case XVI.) vesicles, filled with puriform fluid, are observed. “It is not unusual,” says Callander,‡ “to see patches of dusky discoloration on the integument, or to notice pustular eruptions, or the rapid development of boils.” H. Lee and Wilks have described a pustular eruption as of occasional occurrence. Savory mentions that miliary vesicles are sometimes developed on the chest and adjacent parts.

A reddish erythema-like blush is sometimes seen (as in Cases VI., VIII., IX., X., and XVII.), commencing

* Bristowe, p. 214.

† Callander, p. 271

‡ *Ibid.*, p. 272.

ing in the neighbourhood of the wound, and extending so as to involve (as in Case VI.) the whole of a limb, and the whole of one aspect of the trunk. The colour it presents resembles closely that of erythema or of erysipelas. As in the latter disease, after acquiring a bright red colour, the blush gradually fades, and has disappeared generally by the fourth or fifth day after its first appearance; but it sometimes lasts till the seventh or eighth day. It passes off in the same order as it appeared. The redness of the skin, occurring in pyæmia like that in erysipelas, is occasionally (as in Cases VIII. and X.) followed by subcutaneous purulent infiltration, which is either circumscribed, forming deep-seated abscesses, or diffuse. It is further noteworthy regarding this form of erythema, that it appears on the third, fifth, or seventh days after the first rigor. In this peculiarity it participates with the profuse perspirations and dusky icteric tinge previously mentioned. Along with the erythema we find (as in Case IX.) the superficial veins leading from the wound inflamed and cord-like. Seeing, then, that we have no evidence of this form of eruption spreading by contagion (as is the case with erysipelas), seeing that it is not an invariable attendant on the pyæmic condition, and seeing that it is accompanied by an affection of the superficial veins, is it not probable that it is owing to plugging or other arrestment of the cutaneous capillary circulation? Are not, also, the purpuric patches noticed above (in Case XIV.) owing to circumscribed local venous thrombosis?

Savory has often observed a peculiar odour to be exhaled from the body during the progress of pyæmia.

Morbid Phenomena presented by the Respiratory

System.—Next to the appearances last described, the symptoms most frequently met with are those indicative of an affection of the lungs. Immediately after the febrile phenomena—heat, dryness of the skin, rigors, and perspiration—have abated, the patient complains of a sensation of oppression, or of pain in some part of the chest, and of difficulty of respiration. On the following day he has cough and slight dyspnœa, with expectoration of frothy, viscid, perhaps rusty sputum. Breathing by degrees becomes more and more laboured and hurried. The respirations frequently amount to forty or fifty in the minute, and are sometimes more numerous than this (Bristowe).^{*} After this they are usually accompanied with moaning or groaning. The amount of sputum increases, and purulent nummuli are expectorated. On a microscopical examination (see Case XVI. Plate II. fig. 3) these purulent nummuli are seen to be composed of broken down pulmonary tissue and pus corpuscles. In some instances (as in Case I.) hæmoptysis occurs; at other times there is a feeling of weight at the præcordia, frequent hiccough, and sighing. A careful examination of the chest by auscultation and percussion detects pneumonia at the base of one or of both lungs, with more or less bronchitis. Pleuritic friction sounds may occasionally be detected.

Considerable stress has been laid on a peculiar “heavy,” “sweetish,” “hay-like,” “purulent” odour of the breath, which is observed in pyæmic patients, and which by some is considered to be pathognomonic. If carefully watched for, this symptom is almost always recognisable, and ought to have great weight in the

^{*} Bristowe, p. 215.

diagnosis of the disease. Bérard is generally held to have been the first to direct attention to this characteristic odour of the breath. Like the peculiar odour exhaled by the skin in variola, scarlatina, cholera, typhus fever, and rheumatism, this character of the breath in suppurative fever is very remarkable and of easy recognition.

Pneumonia is not only present in almost all cases of suppurative fever, but it is generally one of the first class of symptoms indicative of organic disease. Some surgeons assert that it is invariably present, and that it marks the onset of pyæmia after surgical operations and injuries. Looking over the previously narrated cases, we observe that pneumonia showed itself on the third or fourth day after the operation, or immediately after the rigors, which ushered in suppurative fever, had passed off.

Notwithstanding the greatly impaired state of the patient's health, the accompanying pneumonia, in pyæmic patients who recover (as in Case XVII.), generally pursues its usual course. In those instances which end fatally, the pneumonic congestion probably aggravates the tendency to abscess formation in the lungs.

We find, then, that the above detailed symptoms are indicative of pneumonia, pleuropneumonia, and bronchitis. The only other symptom of this class, and the only one pathognomonic of suppurative fever, is the sweet, hay-like odour of the breath.

Disorders of the Digestive System.—The organs of digestion, if not deranged prior to the rigor which marks the commencement of pyæmia, are generally affected very soon after it. As a rule, in Lee's experiments (of injecting pus and putrid fluids into the veins

of dogs), "the first constitutional symptoms were derangement of the intestinal system, vomiting, straining, thirst, or purging followed by rigors or nervous symptoms proper, as convulsions, delirium, &c."* After all operations—especially as chloroform is now universally employed on such occasions—the bowels are more or less costive. Constipation, then, is the rule; diarrhoea the exception. The tongue is observed to be furred; sometimes nausea is present, and the appetite is impaired. These symptoms are overcome by the exhibition of a purgative. Improvement lasts for a few days, and the same symptoms then return.

In other cases there is great thirst; the tongue becomes loaded posteriorly, and the papillæ in front are prominent. Sometimes the tongue looks glazed and is fissured. Occasionally the patient is afflicted with flatulence; or there is difficulty of deglutition and rigidity of the abdominal muscles (Case II.); or he is harassed by vomiting (as in Case III.); or his strength is reduced by diarrhoea (as in Cases X., XIII., and XVII.). In the last class of cases the stools are generally highly offensive. Callander observes, "that sickness and vomiting, or diarrhoea with bloody stools, containing shreds of fibrine, mucus, and pus, point to the intestinal canal, and recall the fact, that this disease is sometimes associated with dysentery. Diarrhoea, with copious bilious evacuations, points to the liver, as also do stools consisting of crude food without any bile, especially when combined with jaundice; and this is confirmed by pain in the hepatic region."†

As the fatal issue approaches, the tongue becomes

* Henry Lee, p. 50.

† Callander, p. 272.

more and more dry and brown, and is at last covered with a thick, blackish crust. Sometimes (as in Cases III., IV., XVI., and XVII.) the appetite remains good up to the last.

These symptoms, however, accompany all fatal diseases, and therefore cannot be regarded as pathognomonic of suppurative fever, though they are always present. No reliance can be placed on the condition of the appetite in suppurative fever, seeing that an avidity for food is frequently retained by the patient to the last.

Morbid Phenomena presented by the Nervous System.—The nervous symptoms present in suppurative fever may be concisely termed *typhoid*. Sleeplessness and restlessness at night; during the day, rigors, depression of spirits, or slight muttering delirium, usher in the nervous phenomena observed in this disease. Night after night is spent in wakefulness, with occasional snatches of unrefreshing slumber; by day the patient tosses about, is irritable, is unconscious at intervals, or suffers from various hallucinations (as in Case IV.). The rigor sometimes commences with a violent shaking of the body. Occasionally I have seen it so violent as not only to cause the bed to shake, but to be even perceptible by transmission to the floor. At other times a slight tremulous and cold sensation (called by Scotch patients “grueing”) is experienced. The rigor lasts generally from ten minutes to half an hour, and recurs at intervals of from ten to thirty-six hours, sometimes oftener. “The rigors are sometimes quotidian, and have been mistaken for attacks of ague,” says Dr Bristowe.*

* Bristowe, p. 214.

The patient's worn-out condition next becomes indicated by constant delirium, or by an appearance of collapse from his sinking in bed; or he has confusion of ideas, and does not recognise his most intimate relations; or there is twitching of a certain set of muscles (as in Case II.), or of the muscles of all his limbs. He then passes into a state of continuous unconsciousness, or of coma (as in Case XII.); or becomes maniacal, and dies exhausted (as in Case IV.) Towards the close of life *subsultus tendinum* is almost always present. Sometimes before death the patient fumbles at the bed-clothes, and loses control over the sphincters; at other times he becomes suddenly deaf, and continues so to the last (as in Case XI.) Occasionally (as in Case XII.) rigidity (tetanic-like) of certain muscles—strabismus and priapism—are observed before death, and plainly indicate the formation of intracranial abscess. Rarely are convulsions present.

During the progress of this disease local pains are often complained of, due most generally to affection of various joints; or troublesome cephalalgia is experienced.

The first nervous symptoms generally show themselves on the fourth or fifth, seventh or eighth, fifteenth, twenty-first, or twenty-second, or twenty-eighth days after the operation, or after the accident. Exacerbations also occur most frequently on those days. On the whole, the most commonly observed of these symptoms are, restlessness and wakefulness by night, muttering-delirium, with more or less unconsciousness, ending in coma.

Morbid Phenomena referrible to the Circulatory System.—The pulse in suppurative fever is very

variable. Among the above series of cases we find many instances in which it was not much above the normal standard in rapidity; while in others the pulse had a frequency always of above 90. It is to be noticed, however, that when the pulse rose at the commencement of the pyæmic state, it continued so to the last; and, except in cases of recovery, did not return to the normal standard. As the fever progresses the pulse becomes very weak, compressible, and very variable—slight exertion causing greatly increased rapidity. Savory characterises the pulse in pyæmia as “rapid, small, and feeble,—becoming, as the disease advances, running, flickering, and imperceptible.” Callander says, “The pulse, rising rapidly to 100 or 120 in the minute, is feeble, sometimes intermitting, and though jerking, is easily compressible.”* According to Bristowe, “the pulse, which at the beginning may have been unchanged, becomes rapid, even excessively rapid, weak, and perhaps intermittent; and these evidences of feebleness of the pulse increase as the disease advances. Not infrequently the beats of the pulse amount to 140 or 160, and may even rise to upwards of 200 in the minute.”†

The cardiac sounds are healthy, though sometimes feeble. Pericardial friction is rarely heard, though pericarditis may be present.

The blood (in Cases XIV. and XVI.) was extremely coagulable. On microscopical examination (in Case XIV.) on the third day after the first rigor, the red corpuscles were observed to be accumulated in masses without exhibiting the slightest tendency to

* Callander, p. 271.

† Bristowe, p. 251.

form roulettes ; and they appeared to be disintegrating into moleeules. There were seen at the same time in the field forty or fifty granular, spherical bodies, like pus eorpuseles. In Case XVI. the blood was repeatedly submitted to mieroseopical examination. On the fourth day after the first rigor the blood was found to coagulate with extreme rapidity ; the red eorpuseles elustered together in masses, and some of them had serrated edges. There were, moreover, observed in the field at once about a hundred granular bodies, whieh, in their natural state, and after the addition of aectie acid, presented the usual eharacters of pus eorpuscles. (See Plate I. figs. 1 and 2.)

On the following day (fifth after the rigor) the red corpuseles of the blood were fewer in number, and were evidently disintegrating. There were also seen in the field of the mieroscope granules and numerous granular bodies, whieh, on the addition of dilute aectie acid, showed bright, well-defined nuelei, like pus globules. It will be observed (in Plate I. fig. 3) that the granules eluster around groups of one, two, or four blood eorpuseles, as if they were the remains of pre-existing red eorpuseles.

When examined next day (sixth after the rigor), the red corpuseles were seanty in number, and serrated at their edges, while in the field was seen a great accumulation of granules, and bright, well-defined nuelei, but no granular eorpuseles.

On the seventh day after the rigor, the red corpuseles were observed to have erenate edges, but showed no tendency to form roulettes ; and no granular eorpuseles were seen.

A marked improvement in the patient's constitutional

state is reported on the eighth day, and this is observed also in the blood. (See Plate II. fig. 1.) The red corpuscles of the blood showed a tendency to form roulettes, while a few of them had serrated edges ; and interspersed among them were seen large granular corpuscles like the white corpuscles of the blood, but none of the granular bodies formerly seen.

On the twenty-second day after the first rigor the blood was again examined. (See Plate III. fig. 3.) It was still extremely coagulable ; the red corpuscles clustered in masses instead of forming roulettes ; a few of the red corpuscles had serrated edges ; numerous highly refracting, well-defined granules were scattered over the field, and many granular corpuscles (sometimes as many as sixty at once) were seen floating in the field of the microscope. From this date forward the disease progressed steadily towards a fatal issue ; and the blood continued to be extremely coagulable, and to present the same appearance under the microscope as has been above described.

Mr Gamgee examined the blood microscopically in two cases of pyæmia, and recognised white blood corpuscles in it, and not pus corpuscles. He further confirmed this observation by a microscopical examination of the blood after death.

As occurred in Case XVI., we occasionally have epistaxis, which lasts for a short time, seems to afford relief, and recurs but seldom. In other instances there is discharge from the nostrils or from the ears. It is, moreover, noteworthy that the onset of suppurative fever is often (as in Cases III., VIII., and XVI.) preceded by venous oozing from the wound, or by secondary hæmorrhage. Venous oozing sometimes

recurs (as in Case XVI.) at regular intervals, and is at stated periods followed by rigors. Occasionally the superficial cutaneous capillaries become engorged, and lead to circumscribed local ecchymoses or extravasations.

The term phlebitis was originally applied to the morbid state now termed pyæmia, because the veins leading from the wound in such cases were painful, swollen, cord-like, and marked out by a pinkish, superficial blush. In Case XIV. this condition was well developed. I have seen these phlebitic phenomena, well pronounced in a patient after amputation, pass off gradually without any pyæmic symptoms following.

The general rule, then, is that the pulse is accelerated and weak in suppurative fever; the blood is during life preternaturally coagulable, while it becomes unusually fluid after death; and the red blood-globules are crenate at their edges, undergo disintegration, and are intermixed with granular bodies resembling pus globules rather than white blood corpuscles.

Morbid Appearances of the Urine.—It is a striking peculiarity, which attracts the most casual observer, that though there occur most serious alterations and even destruction of renal tissue in suppurative fever, as proved by post-mortem examinations, these changes are rarely indicated by any marked symptoms during life; they are, in fact, seldom diagnosed during life. The urine in suppurative fever preserves its natural colour. At first its reaction is alkaline, but by-and-by it becomes acid. “Sometimes,” says Savory, “it is scanty and high-coloured.” It contains phosphates, urates, and oxalates in excess; and albumen is generally detectable

in greater or less amount. It has occasionally a strong ammoniacal odour, and deposits chlorides in excess. The urine was from time to time examined in nearly all the cases above narrated; but the results were in all of them so similar, that the following account of this fluid in the patient, Case XVI., may be considered to include all the general characters presented by the urine in this disease.

On the fifth day after the rigor, which ushered in suppurative fever, the urine was examined and found to be of normal colour, of alkaline reaction, and to deposit a sediment containing phosphates and urates in excess; also epithelial cells, a few pus corpuscles, vibriones, and granules. (See Case XVI. Plate I. fig. 5.)

When examined two days later, the urine was normal in colour, of alkaline reaction, contained urates, phosphates, and oxalates in excess; and also some granules.

On the ninth day after the first rigor occurred, the urine was of a straw colour, of alkaline reaction, and deposited a sediment which was seen under the microscope to contain urates, phosphates, oxalates, a few epithelial cells, numerous granular casts, and granules. (See Plate II. fig. 2.)

On examination three days later, the urine was found to be the same as in the last report, but did not contain any urates. (See Plate III. fig. 1.)

Next day the urine was normal in colour, of alkaline reaction, and deposited a sediment containing phosphates, a few oxalates, and granules, but no casts.

On the following day the urine was the same as formerly.

On the nineteenth day, dating from the occurrence of

the first rigor, this fluid was normal in colour, slightly acid in reaction, and contained urates and phosphates in excess, also granular casts, pus corpuscles, and granules. (See Plate III. fig. 2.)

Three days afterwards the urine was of a dark claret colour, of alkaline reaction, and deposited a flocculent sediment containing broken down epithelial cells and granules.

Five days later, on examination, the urine was found to be acid, and contained urates and a few phosphates.

The next examination of the urine was made four days after the last one (a month after the first rigor), when it was found of normal colour, of alkaline reaction, and deposited a sediment, which, under the microscope, was seen to consist of urates, phosphates, a few oxalates, pus corpuscles, very large, round, or oval granular bodies, and granules. (See Plate IV. fig.)

On the fourth day after the last date, the urine was alkaline, and contained phosphates and urates in excess, epithelial cells and granules.

The urine was examined for the last time in this patient four days subsequently, and was normal in colour, of alkaline reaction, and deposited a copious sediment of phosphates and urates, large, round, and oval granular bodies and granules.

When examined quantitatively, the only abnormality observable was a very slight diminution in the amount of urea. This difference in constitution was very trifling.

No characteristic condition, then, is detectable by us on a careful qualitative and quantitative, chemical and histological, examination of the urine in suppurative fever.

The changes exhibited by this fluid are, in fact, not in the least indicative of the amount of pathological lesion which occurs.

Local Morbid Phenomena present in Suppurative Fever.—The wound (or the stump, in amputation cases) looks healthy till rigors occur, and sometimes until almost the termination of the disease. The discharge, which had been previously healthy and abundant, suddenly becomes sanious or watery in character, assumes a peculiar greenish colour, and has a very offensive odour. Or, if the wound has healed almost entirely by the first intention, and has been discharging only a few drops of thick yellow pus, its edges begin to gape, and it discharges a large amount of sanious or grumous fluid. Sometimes a wound, which had previously looked sluggish and unhealthy, takes on an active and healthy character when the symptoms of pyæmia set in ; but it by-and-by changes and assumes the usual pyæmic state.

We next observe that the granulations are pale and flabby, or sloughy-looking and redundant. The discharge, still unhealthy and offensive, diminishes in quantity, becomes scanty, and at last ceases. The wound looks glazed, dry, and stagnant. Sometimes the integument around the wound becomes dusky, indurated, often pustular. The soft parts are flaccid. The bone is bare, and commencing necrosis is observed. The periosteum opposite the wound is generally absent ; or, if covered with granulations, these are pale and glazed, like those of the soft tissues. The remaining portion of the periosteum is thickened, and can be readily separated from the bone.

In Case XIV., the opposite limb to that on which the abscess that originated the disease was situated,

swelled gradually to twice its normal size, and pitted on pressure ; while the superficial veins of the primarily diseased limb were distended, prominent, painful, and cord-like. The pus from such an unhealthy wound, when examined microscopically, showed its corpuscles to be disintegrating into molecules, seeming to undergo fatty degeneration.

The peculiar alterations which occur in bones during an attack of suppurative fever, have been well described by Professor Fayrer of Calcutta, as follows :—"In the acute form (of osteomyelitis), generally within a week or ten days—it may be earlier—after the operation, wound, or injury, the stump, wound, or contusion may have been doing well. It may, perhaps, have sloughed a little, and the sloughs have cleared away, healthy granulations having appeared. The flaps may have united almost entirely by the first intention, at all but a point or two, where discharge continues. The pain is not necessarily acute, and the tenderness on pressure of the stump is but slightly increased. The discharge becomes more profuse, but it is not healthy, well-elaborated pus. A probe being introduced, the bone is found dry and denuded, and, if exposed, the medulla will probably be found protruding like a fungus, while the periosteum is stripped from the end of the bone. . . . At a later period the medulla is found already dead, blackened, and encrusted ; but within it is a putrid mass of bone debris and pus. A probe passes down the entire length of the shaft."*

It is to be remarked, moreover, that unless the constitutional symptoms indicate returning vigour of the

* Fayrer, Prof. Indian Annals of Medical Science, October 1865.

system, separation of part or of the whole of the necrosed bone never takes place. The inflammation of the bone partakes, in fact, of the adynamic character of the disease. During convalescence we occasionally, but rarely, find small sequestra coming out at some of the wounds made to evacuate the secondary subcutaneous abscesses which often form in this disease, or through the original wound of the operation or injury.

In all the above recorded cases, the local symptoms which have been just described were present in a more or less marked form; but in none was there any tendency to separation of necrosed bone. It is, further, curious to observe, that in the case of a double amputation (as Case XVI.), one stump heals completely, by the first intention even, while the constitutional symptoms are markedly pyæmic, and while the other stump is unhealthy and gapes.

These local symptoms, then, indicate merely the asthenic character of the reparative process in the wounds of patients suffering from suppurative fever. Except the peculiar greenish tinge most generally characterising pyæmic pus, the other phenomena cannot be considered pathognomonic.

Accessory Morbid Phenomena present in Suppurative Fever.—We have a very good example of these in Case XVI. On the day following the rigor, which indicated the onset of pyæmia, the patient complained of pain in his right shoulder. It is worthy of remark, by the way, that at the time of accident the patient had his left shoulder-joint dislocated, and this was reduced at the time of amputation; but it was the opposite joint which became affected secondarily. No redness, swelling, preternatural heat, nor sense of fluctuation

existed in the painful joint. Slight swelling was observed four days later, and pain in the joint was excessive. By degrees the joint became stiff and immobile; but no fluctuation was appreciable on the most careful examination.

On the twenty-third day after pain in the articulation was first noted, a distinct sensation of fluid in the joint was felt, and an incision was made, evacuating a large amount of greenish foetid pus. Deep-seated suppuration on the inner aspect of the arm followed, requiring counter-openings. A few days later, on rotating the right arm, a grating sensation in the joint was detected.

Sometimes all the larger joints in the body, at other times those of one limb, or of one half of the body, become suddenly painful and stiff. They swell rapidly, show a reddish blush on their surfaces, or even become filled with pus. In some instances recovery takes place, notwithstanding such an extent of local mischief. Pus in the joints is often attended with much local distress; but it not infrequently accumulates insidiously, so as not to be suspected during life. Occasionally (as in Cases II. and XV.) the other symptoms of arthritic invasion are present, and swelling or effusion into the joints is wanting. It is also sometimes observed that one joint at a time becomes affected, suppurates, discharges, and heals up; and then another takes on the suppurative condition, and so on alternately.

The glands are sometimes enlarged and indurated (as in Case VII.), or they may become the seats of circumscribed suppuration (as in Case XIV.)

Secondary abscesses in the cellular and muscular tissues are more commonly met with than those last described. No part of the body is exempt from this

form of the affection. They occur most frequently, however, in the immediate neighbourhood of wounds. In Case II. such a secondary inflammation was found during life situated over the sacrum. The formation of such abscesses generally takes place insidiously without being attended by any acute symptoms; and they are often detected only after death.

Among the twenty cases I have narrated, the pathological lesions found after death are described in twelve instances; and, among these twelve, abscesses in the subcutaneous tissue were during life unobserved in seven instances, and detected for the first time on the post-mortem table. One or more of the joints were found in a state of suppuration in Cases II., IX., and XVI. In Case I. two deep-seated perineal abscesses were discovered after death. In Case IV. secondary abscesses were found after death in different parts of the body, and one of large size in the right psoas muscle; *i.e.*, on the opposite side to that of the injured limb. In Cases II., XI., XIV., XVI., XVIII., and XX., the collections of pus among the soft tissues were present in the neighbourhood of the wound, and confined to the injured limb. Gamgee mentions having met with three instances of abscess of the prostate, as a secondary complication of pyæmia;* and in all of these instances this secondary deposit was not detected during life. Instead of pus, a granular fluid sometimes forms the contents of the local abscesses we have before described.

This secondary abscess formation is the most charac-

* Gamgee, J. S. 1853, p. 188.

teristic symptom of suppurative fever with which we are at present acquainted. It is not indeed met with in every instance of the disease, but, when coexistent with any of the other symptoms, it is pathognomonic.

Such are the symptoms presented by patients suffering from acute suppurative fever. "In other instances," says Callander, "the affection is less acute, and the symptoms simulate those of typhoid fever. In this second modification the action of the animal poison is purely local, and is oftener recovered from; and, if fatal, its progress can be explained by predisposing causes, or by changes which depend upon secondary causes."* This form of suppurative fever may be termed chronic suppurative fever. It is no doubt frequently met with, especially in private practice; but very few instances of it have been carefully recorded and published. According to Bristowe, Wilks, and others, the chief evidence of chronic pyæmia is the occurrence of successive suppurations in the joints, in the cellular tissue, in the eye, and in other parts. In the above series of cases we have one instance of this form of suppurative fever (Case XII.); but the most important portion of the history of this case is unfortunately wanting.

Chronic suppurative fever presents three varieties, similar to one another, but at the same time sufficiently different to deserve separate notice. These varieties may be termed *subacute*, *idiopathic*, and *relapsing*.

(A.) The *subacute* variety of chronic suppurative fever is the one most commonly met with in hospitals,

* Callander, p. 267.

and to which some have applied the name chronic pyæmia. Among the afore narrated cases there are several more or less marked examples. Case XVI. furnishes a typical illustration of the semeiology of this variety of pyæmia. A patient, on the fourth or fifth day after an operation, is seized with rigors, or presents some other symptom which indicates the invasion of his constitution by the subtle poison of suppurative fever. He suffers from profuse perspirations; requires opiates at bed-time in order to secure a few hours of sleep; probably has bronchitis, or is attacked with pneumonia; becomes delirious, emaciated, and despondent. Generally, however, his appetite continues to be good, or at all events he takes a considerable amount of nourishing food; the granulations of the wound look pale and inactive; the discharge becomes ichorous and offensive, but does not cease. By the careful frequent administration in small quantities of nourishing diet and stimulants, by the use of various lotions to the wound, by the strictest attention being paid to the evacuating, at as early a period as possible, of secondary abscesses, and to the various other remedial measures which will be by-and-by specified, the patient lingers on, hanging to life by a thread seemingly, and often falsifying the predictions of his fatal issue, until health very slowly returns. Convalescence does not progress uninterruptedly, as is the case in most other fevers. While on one day the wound looks more active, the discharge healthier, the patient is improved in spirits, and has a better appetite for food; on the following day he is depressed, perspires more profusely, and is not inclined to eat. The local appearances, moreover, in such cases generally betoken

health, the granulations being bright and not redundant, the discharge healthy and abundant. The wound heals even while the constitution is being undermined by suppurative fever. When secondary abscesses form, or the joints become affected, one part generally heals up before another is invaded; but the healing action in such instances is often a drying up of the wound rather than a proper reparative process.

Thus, this subacute variety of suppurative fever, showing itself from the commencement as such, or being the remains of an acute attack, pursues its lingering course over weeks or months, and terminates either in recovery or death.

(B.) Suppurative fever is sometimes of spontaneous origin, or *idiopathic*. No exciting cause can be found, nor predisposing circumstance discovered. The fever supervenes on some disease which in most instances is lingering but not fatal, and in which there is no tendency to suppurative inflammation. It is characterised by symptoms markedly different from those of the other varieties of pyæmia. A very good illustration of this form of chronic suppurative fever is narrated in the "Association Medical Journal."* The patient was, in this instance, admitted into hospital with a troublesome condition of the bladder. He had no wound on any part of his body; he had undergone no operation; and, generally speaking, he was not very ill. A few days after admission he showed all the signs of suppurative fever, without having experienced any rigors. His condition became more and more markedly pyæmic, and he died. A careful post-mortem examination was made;

* The "Association Medical Journal," 1856, p. 801.

secondary abscesses were detected in the kidneys, and on one side in the cellular tissue, between the bladder and rectum, while the whole body was studded with subcutaneous abscesses.

Mr Gamgee alludes to this variety of chronic suppurative fever. Dr Wood says, "I have had under my care in the Pennsylvania Hospital, a patient with all the symptoms characteristic of purulent infection, including abscesses in various parts of the body, erysipelatous inflammation here and there upon the surface, and general typhoid symptoms,—who was attacked in consequence of exposure to severe cold, great privation, and fatigue, with habits of intemperate drinking, and without any discoverable original inflammation as the starting-point; and this is by no means the only case of the kind which has come under my observation."*

This variety, then, of chronic suppurative fever, is distinguished by its idiopathic origin—not by symptomatology, course, or treatment.

(C.) Mr Paget gives a very striking example of *relapsing* suppurative fever. The term *relapsing* he also uses, and includes this form of the disease under the head of chronic pyæmia. His Case III. furnishes the symptoms, progress, and result of this variety of suppurative fever. Recovery in such cases is more common than in the other varieties of this disease. But though life be preserved, and though health be restored, it is seldom that the fever does not leave irreparable evidences of its past power over the system. The wasted muscles, the more or less anchylosed joints, and the numerous cicatrices which cover the

* Wood, G. B., vol. ii. pp. 254, 255.

body of such a patient, remain as unmistakeable traces of this disease.

“Its course is indicated by slow wasting, all the tissues becoming dry and shrivelled; by increasing pallor; by decreasing muscular and mental power, the voice becoming weak, the mind slow and dull, and at night often wandering; by quickness and feebleness of the pulse and breathing; by frequent and profuse sweatings, especially when there is much suppuration; by less frequent chills or rigors; by increased thirst and usually aversion from food; by dryness and shrinking of granulations.”*

Instances of this form of suppurative fever are very rarely met with in hospitals; but they, no doubt, often occur in practice. They are, probably, often mistaken for other diseases, till a post-mortem examination astonishes the practitioner by disclosing a large array of visceral abscesses.

Summary of the Symptoms of Suppurative Fever.—Having thus described in detail the symptoms presented by the acute and chronic forms of suppurative fever, and by the subacute, idiopathic, and relapsing varieties of the latter form, we may now summarise the whole as follows. Commencing suddenly,—generally with rigors and pyrexia, sometimes with a depressed and anxious countenance,—we next observe the patient suffering from bronchitis or pneumonia, profuse perspirations, a dusky and icteric discoloration of the conjunctivæ and skin, a peculiar heavy or purulent odour of the breath, disinclination to food, extreme prostration, restlessness, then muttering, and lastly

* Paget. Bartholomew's Hospital Reports, 1865, vol. i. p. 2.

maniaeal delirium, a rapid pulse, and increased temperature of the skin. These are the constitutional symptoms which characterise this disease, and which are accompanied by the formation of secondary abscesses in the joints or beneath the skin ; while the wound (if present) becomes stagnant, its granulations look glazed, the discharge becomes sanious, offensive, or of a bluish-green colour, and the edges gape.

Except in the acute form, where the fever becomes aggravated or diminished in severity generally on the seventh or eighth, on the fifteenth, the twenty-first or twenty-second, or on the twenty-eighth day after its commencement, one of the peculiarities of suppurative fever is the absence of nearly all respect to time which it exhibits. This corresponds with the irregular character of the discharge from the wound in such cases ; with the absence of any indication of the existence of a single infecting material ; with its analogy to such dissimilar diseases, as erysipelas, cellular inflammation, and puerperal fever ; with its inexplicable character of being sequent on the most trivial injuries and operations, as well as on the most serious ; on diseases in which no pus is present, as well as on those which require the formation of pus for their cure ; and with the rapidity of the formation of secondary abscesses, the asthenic character of the inflammation, and the very general distribution of purulent deposits over the body.

CHAPTER V.

ON THE PROGRESS OF SUPPURATIVE FEVER.

THE ordinary course pursued by this fever has been for the most part indicated in the remarks on the symptoms of this disease. Besides referring briefly to these, it will be advantageous to notice certain complications which occasionally accompany this affection, and likewise the sequelæ which sometimes occur after convalescence has commenced.

The Stages of Suppurative Fever.—The symptomatology of suppurative fever points to certain stages, which are generally more or less well defined. These stages resemble those of other fevers in being characterised by certain symptoms, in bearing a certain relation to time, and in observing a definite succession. Four stages may be described:—

The Stage of Incubation ;
The Stage of Invasion ;
The Typhoid Stage ; and
Convalescence.

It will be observed that no mention is made of the crisis, which in other fevers is a most important point. As yet a sufficient amount of observation on the progress of suppurative fever has not been collected to enable us to define such a period as the crisis. No

doubt by-and-by this point will be more clearly settled, and, in the meantime, we must speak of convalescence as following the typhoid stage of suppurative fever, without any limit between the two stages being detectable. The twenty cases I have before reported are arranged in the preceding table, p. 136, with the view of showing the succession and the duration of these four stages.

The *incubative* stage of suppurative fever is a latent indefinite period, which doubtless exists, but cannot be specified. In the case of contagious fevers, data, pointing to certain media of contagion, or to the existing action of certain epidemic influences, can be employed as fixed points, from which to reckon the commencement of the stage of incubation. In suppurative fever there are no such fixed circumstances from which to calculate. This fever is not contagious, and, though sometimes prevalent, cannot be strictly spoken of as epidemic. As to the duration, then, of the incubative stage of suppurative fever, and as to the symptoms which characterise it, nothing definite can be stated at present.

An *attack* of suppurative fever may be dated most correctly from the occurrence of the first rigors; or, when this symptom is absent, from the time at which depression of spirits, or any of the other premonitory symptoms before narrated occur. As has been before remarked, pyæmia and puerperal fever generally set in on the fourth or fifth day after an operation, injury, or delivery. In fifteen among the twenty cases I have quoted, as seen in the preceding table, rigors were experienced, and this symptom served to fix the stage of invasion. In two instances the

history of the cases was too indefinite to enable us to specify the stages of the fever; and among the remaining three cases the stage of invasion was marked in one by pulmonary symptoms, in another by pyrexia, while in the third case an anxiety of expression first betrayed the change for the worse which had taken place in the patient. The accession, then, of suppurative fever is indicated generally by rigors, followed by increased temperature of the skin, profuse perspirations, and thirst. This pyrexial condition has scarcely passed off, when the patient is attacked with bronchitis or pneumonia. The appetite is rarely affected at this stage of the fever, and for a few days (three to ten days) after the commencement of this stage, the constitution is apparently not affected. The patient complains of cough, restlessness at night, rigors at intervals, and of profuse perspirations; but in other respects he appears to be pretty well, when suddenly the typhoid stage sets in.

The *typhoid stage* is characterised by extreme prostration, low muttering delirium, and by more or less unconsciousness; by the dusky-yellow (pyæmic) discoloration of the skin and conjunctivæ; by disinclination to food; by the purulent odour of the breath, and by the formation of secondary abscesses. Locally, this stage is marked by a sloughy inactive condition of the wound, and is accompanied by an ichorous, foetid discharge. What this condition is due to we are unable at present to state. Whether the typhoid symptoms are owing to the retention of urea in the system, decomposed and eliminated as carbonate of ammonia, which is supposed to be the case in typhus; or whether they are ascribable to the presence in the blood of sul-

phuretted hydrogen, or of some other gas, or of some foreign substance generated by the suppurative process in the viscera or in the wound,—requires to be determined by further research. That the systemic infection has not a local origin, but that the changes in the blood, which induce the typhoid symptoms, commence in the lungs either in consequence of deficient oxydation of the blood, caused by the pneumonic hepatisation of the pulmonary tissue, or in consequence of some specific agent developed in the contents of the secondary pulmonary abscesses,—will, I think, be acknowledged by all. Pus, as such, has nothing to do with inducing suppurative fever, nor do its liquid contents produce this condition; but it is probable that some catalytic process is excited by purulent fluid in contact with imperfectly oxygenised blood. When the typhoid symptoms advance rapidly, the discharge is profuse and the prostration extreme, death taking place in from three days to a week after the commencement of this stage.

As regards *convalescence*, the symptoms which mark a return to health are developed very gradually. An improved appetite and better spirits are generally the first signs of amendment. In Case XVII., the only instance of recovery which I have cited, convalescence set in on the fourteenth day after the commencement of the typhoid condition. On careful observation of cases of recovery from suppurative fever, it will be found, I believe, that the stage of convalescence, like the other stages of this fever, exhibits a periodical character, *i.e.*, that it commences generally at dates corresponding to weekly periods. For example, in Case III. secondary hæmorrhage and rigors occurred on the fifteenth day after

amputation ; seven days later the typhoid stage set in, and a week thereafter death occurred. This periodical character of suppurative fever is illustrated by the first table in the "Appendix of Statistics."

The Complications of Suppurative Fever.—The morbid states which most generally complicate suppurative fever are—*bronchitis*, *pleuropneumonia*, *phlebitis*, *erythema*, and *bed-sore*. These are to be distinguished from those diseases in the train of which suppurative fever occurs.

At the commencement of suppurative fever *bronchitis* and *pleuropneumonia* are very often present. These complications are readily diagnosed by their characteristic physical signs and symptoms. They are to be regarded as serious accessions, in as far as they tend to weaken the constitution and interfere with the normal oxydation of the blood. Bronchitis is to be treated by expectorants, combined with stimulants. In the initiatory stage, both of bronchitis and of pleuropneumonia, diaphoretics are very useful. When friction is detected, it is best to apply a blister over the affected area ; and the oppressed sensation during respiration, experienced in an attack of pneumonia, will be relieved by the constant application of warm poultices. The patient's strength, also, must be supported with stimulants and nourishing food. Pulmonary complications, chiefly pneumonic, were observed during life in Cases I., II., VI., VII., VIII., XI., XIII., XVI., XVII., and XIX.

Phlebitis was formerly considered to be such a frequent precursor of suppurative fever, that these names were used synonymously ; and the former term has been applied by some writers to the constitutional condition

which characterises suppurative fever. The distended, thickened, obstructed veins, painful on pressure, and mapped out on the skin by distinct and delicate pink streaks, are seen passing along the limb from the seat of irritation. This condition is sometimes ushered in by well-defined pyrexia, and is followed by serous exudation into the subcutaneous tissue, which distends the limb to twice its normal dimensions. The veins are prominent, cord-like, and of a dark purple hue. This complication deserves to be regarded as the most serious one which is met with in the course of suppurative fever. It commences in an insidious manner, and soon produces a blocking up of the veins, which may lead to dire results, not to be overcome by any known remedy. If detected in the early stage, before the veins of the limb have become to any extent obstructed, the use of tepid opiate lotions, or of Goulard's lotion, with rest to the part, will be serviceable in relieving pain and redness, and may, perhaps, be effectual in preventing the further spread of the coagulating action in the vein. In the more advanced stage of phlebitis, the inflammatory process spreads with such rapidity that, beyond relieving its symptoms by the employment of such lotions as those just specified, and by strict attention to the elevation and rest of the affected limb, no treatment likely to prove of service can be recommended. If the vein of a limb is blocked up, and becomes the seat of a subcutaneous abscess through suppuration of the coagulum on the distal side of the obstruction, the surgeon, when confident that such a condition is present, should not hesitate to evacuate the pus with the knife. The serous effusion which remains, after the subsidence of the acute stage of phlebitis, is best got rid of by bandaging.

In Case XIV. we have a good example of this complication.

A not less frequent, and a much less grave, complication of suppurative fever, is an *erythematous* or *erysipelatous* condition of the skin. This affection resembles erythema and erysipelas, but differs from both, probably, in its pathological character. It was well marked in Case VI. The symptoms of this affection often consist, in the first instance, of rigors and pyrexia. Around a wound is next observed a reddish-pink, uniform discoloration, disappearing momentarily on pressure, and accompanied by puffy swelling like that met with in erysipelas. This erythema-like blush spreads rapidly, and in two or three days may cover the half of the body. It disappears with equal rapidity, and, during convalescence, an itching sensation is occasionally complained of. Unlike erysipelas, this affection leaves no traces behind it, such as suppuration of the cellular tissue. It is owing, probably, to engorgement of the cutaneous capillaries from sudden obstruction of some of the larger vessels.

The less that is done in the treatment of this complication the better. It does not annoy the patient, is not in itself dangerous, and does not leave any sequelæ. Hence it should be left to run its natural course ; and the itching which is sometimes experienced in this, as in other cutaneous eruptions, is readily relieved by sprinkling the part with fine flour, or some similar powder.

The last in order of occurrence, and the most troublesome complication of suppurative fever, is *bed-sore*. As in all diseases in which there occurs a typhoid condition, with proneness to sinking in the bed, sores

are very apt to form over the sacrum and hips. It is only by the most vigilant nursing that they can be prevented ; and, if this is overlooked, they are generally not detected till they have attained a considerable size. They are preventable in most instances by attention to the avoidance of pressure on such osseous prominences as the coccyx and the ischial tuberosities, by the use of water cushions, or of beds specially adapted for this purpose. When a bed-sore has formed, if the slough has not separated, poultices should be applied ; and if an ulcerated surface exists, it should be dressed with various lotions like other ulcers, at the same time always endeavouring to remove the evident cause. Besides local measures this complication requires the diligent use of constitutional remedies, such as abundance of stimulants and of nourishing food. Bed-sores are very rarely unavoidable, and they are for the most part caused by inattention on the part of nurses. Hence, every surgeon in treating a case of suppurative fever should bear in mind this complication, and should himself see that measures are used to prevent the formation of bed-sores. Thus he may not only save life, but he will render the treatment of his case more simple and uncomplicated.

Lastly, as to the Sequelæ of Suppurative Fever.—Numerous cicatrices remain to show the free use of the knife, which is all-important in the treatment of this disease. But, in addition to such slight deformities, the appearance of patients is sometimes considerably altered by the extensive local suppurations which occur in this disorder. The joints are most frequently involved, and they become contracted to such an extent as to be occasionally not only unseemly but useless. Care,

therefore, should be taken during convalescence to move affected joints gently and regularly every day. If the joints are not themselves the seats of suppurative changes, the pain caused by exercising the muscles which move them, or the injury caused to the diseased bones by the use of the adjoining articulations, requires the joints to be kept perfectly still, even though in a contorted position. Thus a deformed joint may be the secondary result of local suppuration. It is easier, however, to overcome such deformities than those due primarily to suppuration in the joints; for, in the latter instance, the articulations are generally completely disorganised. The thorax, as occurs occasionally after pleurisy, may be distorted through firm, old adhesions,—a state of matters which it is very difficult to rectify.

The most serious sequela of suppurative fever, and one which often cannot be guarded against by the greatest care and skill, is that constitutional debility which renders the patient liable either to a recurrence of his last ailment, or to disease of a chronic wasting character, such as phthisis.

CHAPTER VI.

THE TREATMENT OF SUPPURATIVE FEVER.

THE treatment of suppurative and puerperal fevers consists in part of prophylactic, and in part of remedial measures. Though it may appear paradoxical to say so, prophylaxis is the chief means of combating this disease. It must be evident from a perusal of the preceding chapters on the symptoms and progress of this fever, that too much stress cannot be laid on the various agencies which our experience of other fevers has proven to be effectual in preventing the origin and propagation of any constitutional affection like that under consideration.

(A.) PROPHYLACTIC MEASURES.

I. *Measures tending to prevent the Origin of Suppurative Fever.*—As long as the exciting cause of suppurative fever is wrapt in the mystery which at present surrounds it—as long, too, as the remarkable eccentricities we have described before cannot be traced to any specific source,—so long must the origin of this fever be combated only on general principles. In considering, however, the various means which should be employed to avert the aggression of this fever among surgical and puerperal patients, it cannot be too emphatically asserted that disappointment often attends

the most strenuous efforts which are used to prevent its development.

Hygienic Prophylaxis.—This fever, unlike typhus, is not essentially traceable to overcrowding, deficient ventilation, and other conditions, which tend to debilitate the constitution. I have mentioned, under the remarks on etiology, a very striking illustration of this fact, which came under my own notice in connection with the patients suffering from suppurative fever in wards A and B. In private practice, moreover, the majority of such cases are placed in the most favourable position as regards hygiene. Suppurative fever attacks, also, operation cases in our small county and borough hospitals; though the sanitary arrangements of such institutions are satisfactory, and the number of operation cases which they contain is comparatively small. On the other hand, many surgeons, especially those in the public services, and those who officiate in large hospitals, have been struck by the coincidence of an outbreak of pyæmia occurring only when there was an accumulation of cases of severe wounds and of operations in a ward. And the observation quoted from Sir J. Y. Simpson's obstetrical works, of a cessation of puerperal fever following the use of disinfectants and attention to ventilation, strongly corroborates the theory of such an occult source. Another illustration of the influence of improved hygiene is mentioned by M. Sédillot, who states that formerly a moat filled with stagnant water existed near Strasburg Hospital, and then few patients were saved after operations; whereas, after this moat was filled up, the success was great.

While, therefore, ventilation, nourishing diet, and the removal of any depressing influence, are not to be

considered all-powerful means of averting pyæmia, inattention to the use of such prophylactic measures is highly censurable.

The strength of patients after operations is often greatly reduced by the exhibition of a purgative ; and hence it is advisable to have the bowels opened in such cases for the first time with an enema, and to avoid purgatives. When an hospital patient is attacked with suppurative fever, he should be isolated if possible ; and the ward in which he is placed should be kept warm and fresh, but draughts cannot be too carefully guarded against. The question as to whether it is preferable to have large wards in an hospital accommodating a considerable number of patients, or smaller wards to hold only two or three, is one of those debatable points which afford endless ground for discussion. Both have their advantages, and both their disadvantages ; but my preference is for the former. Among patients, especially when a number are collected together, there is great diversity of character, and a wonderful sympathy is always excited by suffering. In a large ward one is more likely to have some with a cheerful, hopeful disposition, who, besides being useful in attending on their fellow-patients, do, by giving occasional vent to the superabundant hilarity of their nature, cheer up the more despondent, and thus effect what physic would be powerless to accomplish. Thus, no doubt, the depression of spirits which is so apt to be excited by severe surgical ailments, is very frequently warded off. Fresh air, good food, and a cheerful disposition, are very important means for preventing the aggression of suppurative and puerperal fevers, and should on no account be overlooked,

Though too much confidence in treatment intended to prepare a patient for operation will be found by experience to meet with disappointment; yet such measures as serve to place a patient's health in as favourable a position as possible for overcoming any illness he may suffer from, should be carefully studied. He should, accordingly, be accustomed to hospital air and food, and his various functions rendered as active as is consistent with health, before he is required to undergo the operation.

II. *As to the Prophylactic Measures useful for Preventing the Propagation of Suppurative Fever.*—These include the consideration of such media of contagion as have been found to favour the spread of other fevers, as small-pox and typhus, viz., free intercommunication between the inmates of different wards, and likewise between the attendants on different wards. I have been unable to trace any deleterious influence to the interchange which constantly takes place in the surgical wards of our hospitals. As stated in the chapter on etiology, the wards A and B for male patients, and the ward C for female patients, were all on the same flat, contained surgical cases alone, and had a common corridor. The nurses of these two sets of wards were almost hourly within such a distance of each other as to be able to communicate contagion if it existed; students passed freely and frequently from one of these wards into another; visitors had likewise free access to the wards; yet suppurative fever occurred in only one of the male wards at once, and never showed itself in the female ward (which was of the same size as ward B, and six or eight of whose ten inmates were generally operation cases). It is only among diseases which rage epidemically that contagion seems

to spread through attendants, and such like media. Sponges, however, should on no account be used in the dressing of suppurating wounds, for they act injuriously by retaining impurities. There appears to me to be no cause to apprehend the induction and propagation of suppurative fever by means of nurses, or through the medical attendant.

(B.) REMEDIAL MEASURES.

Having considered the prophylaxis of suppurative fever, we shall now refer to the constitutional and local remedial measures to be employed in the treatment of this disease. This class of means may be further subdivided into Hygienic, Pharmaceutical, and Operative Remedial measures.

I. *Hygienic Means of treating Suppurative Fever.*—The constitutional or general hygienic measures consist in ventilation, nourishing diet, and attention to warding off those influences which tend to debilitate the system. The room in which the patient lies should be frequently purified by washing, and by employing disinfectants, such as M'Dougall's powder, followed by the use of perfumes, so that the air may be fresh and fragrant. Food, in the most nourishing and most easily digestible form, should be given at short intervals, and in moderate quantities. Stimulants, administered with a bountiful but discreet hand, are very important auxiliaries in the treatment of this class of fevers.

The local hygienic remedies are disinfectants, such as Condyl's fluid, Chevalier's lotion, carbolic acid lotion, chloride of zinc lotion (zinc chlor. gr. 40, aq. 3j.), and the like. The discharges from wounds should have free vent, but all unnecessary exposure of wounds to the

atmosphere is highly objectionable. The continental method of dressing a stump, by heaping on it layers of charpie and lint, tends only to favour the putrefaction of the discharges, and is most uncomfortable to the patient. The more lightly a stump is dressed, the better. Coagula should be removed by syringing the interior of the stump with tepid water containing some disinfectant fluid; and it is advantageous, after the stump or wound has been dressed (especially when the amount of discharge is great), to place some tow soaked in a disinfectant fluid round the stump or limb. Secondary abscesses should be evacuated as early as possible. The purulent contents of such abscesses are far from healthy, totally inactive, and would never be absorbed, but aid in the degenerative process which is going on in the neighbouring tissues.*

Rest is another local means productive often of inestimable benefit; and the neglect of which is equally injurious. "How often," says Sédillot, "have not patients been considered as cured, whose partially cic-

* Röser also recommends this plan of treatment. He considers that pyæmic patients should be isolated, and visited last; and that autopsies in fatal cases of this class should not be made by the practitioner in attendance. Röser ascribes diffuse inflammation, tetanus, and pyæmia to miasmatic agency.

Mr P. Hewett "has found no medicines, save opiates, to be of any use in this terrible disease." He treats cases of pyæmia by giving rum and milk in the early morning, strong animal broth from time to time, and stimulants, wine or brandy according to circumstances; with an opiate at night and sometimes during the day. He records ten cases of recovery from pyæmia, and states that "he has seen bad cases, in which the internal organs were seriously implicated, recover under this treatment."

Prof. Jüngken strongly advocates the employment of baths, both general and local.

trised stumps yet presented fistulous apertures, from which daily escaped a certain quantity of pus! I found such patients in a yet more precarious position one, two, three, or even six months later, their health having become deteriorated, and a fatal pyæmia being set up." This shows the risk of too early dismissal from hospital.

II. *Pharmaceutical Means of treating Suppurative Fever.*—Numerous and varied as are the drugs which have been advocated as efficient cures of this disease, each and all have been found to fail quite as often as they have proved successful. During the incipient or latent stage, so to speak, of suppurative fever, therapeutic measures are of use chiefly in alleviating symptoms. It affords relief, and is beneficial to open the bowels gently with a purgative, or (if it be the first evacuation after an operation) with an enema, to overcome the dryness and heat of the skin by diaphoretics and vapour baths, to excite the kidneys by means of diuretics, and to procure sleep by the aid of opiates. But the character of this disease, aptly designated as "action without power," must ever be borne in mind. "The excitement of the system," says Lee, "will imitate all the acts of genuine inflammation without any of its healthy results; and loss of energy will appear immediately after, or even arise in conjunction with, the first symptoms of increased action." Hence, any course of treatment which tends to lower the vital energies must be carefully guarded against. "I am certain," observes Cruveilhier, "that diseases resulting from purulent infection would not be stamped with the seal of incurability, and that nature, seconded by art, would triumph in the majority of cases, if the pus, which is incessantly renewed, did not incessantly renew the sources of infec-

tion. By bleeding, a portion of the *materies morbi* is, no doubt, abstracted with the blood ; but, as it is constantly being reproduced, the constitution is only deprived of the power it would otherwise have of resisting the disease."

For disturbance of the circulation, Callander recommends *digitalis*, the strong tincture of *aconite*, and the preparations of *veratrum nigrum*.

When the disease is well pronounced, when, in fact, the surgeon has made up his mind that the case is one of suppurative fever, tonics must be freely administered. The best with which we are acquainted are the preparations of iron, in combination with some one of the bitter vegetable infusions. Nor must the surgeon be at all loath to persevere in the use of these remedies ; for though they cannot cure the disease, they support the system, improve the blood, and thus aid the "*vis medicatrix naturæ*." Frequent examinations, physical and otherwise, should be rigorously attended to. A poultice applied over the chest at the onset of pneumonia, or counter-irritation employed when friction is for the first time detectable, will serve to relieve the patient's symptoms, and thus combat the pulmonary complication. The urine should be tested from time to time ; and suitable remedies, in accordance with its condition, should be prescribed.

Now, as to the curative or specific agents which have been employed in the treatment of suppurative fever. These have been based either on the theory of a supposed elimination of the poison by the system, which can be aided by such remedies ; or on the idea of combating the poison in the system, dissolving, or in some other way overcoming it ; or the remedies have been considered efficacious through analogy ; or their advo-

cates have employed them for empirical reasons without having any theoretical basis whatever. Hence, we find the older surgeons approving of purgatives and diaphoretics as means of eliminating the poison through the excretions. Professor Polli of Milan, considering that the pyæmic poison acted as a ferment, and seeing that sulphurous acid arrested this catalytic process, strongly advocated, a few years ago, the administration of sulphites (which prevent fermentation without being injurious like the acid) in the treatment of pyæmia. Professor Polli, at the meeting of the British Medical Association held in August 1867, said, "It has long been admitted in medicine that there are diseases whose cause and origin is a specific ferment, either generated within the system, or introduced from without. The sulphitic salts do not act as poisons towards the several morbidic ferments which we have supposed to be the causes of the several zymotic diseases. They do not kill the catalytic germs of the organic poisons; but they react on the material components of our organism, rendering it, by their presence, incapable of being acted on by these catalytic germs,—they 'neutralise' these poisons." In his experiments on dogs, Professor Polli found that the exhibition of sulphites delayed putrefaction. Professor Burggræve, of Ghent, recommends the employment of sulphite of magnesia in pyæmia.* This class of remedies failed in Mr Simon's practice at St Thomas' Hospital.† If Professor Polli had, in the first instance, proved the fermentative character of the poison of suppurative fever, his mode of treatment would have been

* Burggræve. See Braithwaite's "Retrospect of Medicine." 1866. Vol. liii. p. 333.

† Callander, p. 224.

more appreciable.* Our knowledge of other fevers, and the astonishing success which has attended their treatment of late years as compared with former times, seem to me to show that, even if we were acquainted with the poisonous agency in the blood, which in one instance induces typhus, and in another measles, such knowledge would not enhance the value of remedies whose action on the living organism is little known. Even though we could extract this poison from the system, could define its chemical nature, and could then render it innocuous by the admixture of sulphites or other agents, nevertheless such knowledge would not entitle us to predict that the internal use of these remedies is a specific cure for this disease. "That we can prevent," says Savory, "the decomposition of blood in a bottle, or destroy its putridity, by mixing it with an antiseptic, affords nothing like proof that the same substance, if mingling with the blood as it circulates, will arrest the changes which a putrid fluid may set up." We should, accordingly, be gratefully content with the advance of knowledge in this direction, and should endeavour to discover new modes of investigating disease rather than

* Burggrave prescribes the sulphite of magnesia in half drachm doses every one or two hours, so as to saturate the organism rapidly with it, and to cause the fluids of the body—urine, saliva, and sweat—to contain it. Polli, on the other hand, administers the sulphites as prophylactics in surgical cases. He gives four to six drachms of the sulphite of magnesia, or the hyposulphite of soda, during the first twenty-four hours, and six to nine drachms during the next twenty-four hours, "to prepare a patient for an operation or a labour." He adds a little caustic magnesia to allow of the sulphite being better retained by the stomach. Professor C. O. Weber, of Bonn, also experimented with the sulphites; but his results were not very satisfactory.

waste time in searching after forms of facts whereby to prop up theories.

“I have been led to believe,” continues Savory, “that in some cases the employment of the alkaline salts, such as the bicarbonate of potassa, has proved of service. I think it has been shown that alkalies promote the changing and eliminating of the products of the retrograde metamorphosis of the tissues; and in this way, apart from whatever direct action they may exercise upon the poison itself, they may assist us in our management of pyæmia. The simple alkalies are more likely to act depressingly than the bicarbonates. I have usually chosen the bicarbonate of potassa, and combined with it the carbonate of ammonia.”

Some have proposed the liberal use of quinine and of arsenic, on account of the striking analogy of suppurative fever with ague. Velpeau recommends the sulphate of quinine, when the intermissions are very marked and there is no irritation of the stomach. Marjolin and Blandin state that with quinine they have destroyed the periodicity of the disease.* As will have been observed in some of the cases I have narrated, quinine has no action in controlling the fever, and serves only as a tonic.†

Paget says that the influence of liquor potassæ in pyæmia “deserves consideration,” and he mentions an

* “Journal Hebdomadaire,” tom. ii. p. 699.

† M. Woillez gave 9 grs. of tannic acid daily in two cases of puerperal pyæmia in which there were multiple subcutaneous abscesses, especially in the vicinity of the joints. Quinine in these instances “seemed to aggravate rather than to relieve the symptoms.”

M. Batailhé “treats cases of pyæmia by dressing their wounds with alcoholic liquids, so as to prevent the putrefaction of the discharge, and to close the mouths of the open veins and lymphatics.” In puerperal fever he recommends alcoholic injections.

instance in which it seemed to be directly efficacious in overcoming the disease.

III. *Operative Means of treating Suppurative Fever.*

—The treatment of suppurative fever by operative measures has also been various. In order to get rid of the pyogenic membrane which reproduces the pus, and thus renews the morbid agent, Bonnet advocated the application of the actual cautery over the surface of the stump or to the suppurating wound. For this purpose Sédillot considers escharotics to be quite as efficient, and preferable, from their acting more slowly. Sédillot, however, recommends the use of the actual cautery in order to obliterate the veins, and to modify an unhealthy foetid condition of the wound. He further believes that ablation of the suppurating parts is of great efficacy. With regard to these proposals it may be enough to say, that inasmuch as they act on the effect, rather than on the cause, they are of little use. After the employment of an escharotic, or the application of the cautery, a sloughing wound may exhibit a transitory improvement. But this temporary local excitement produces increased action in the part, and an increased amount of discharge; and, the constitution being already involved, this inflammatory process partakes of the constitutional apathy, instead of assuming a healthy adhesive character. Of more recent date is the proposal to get rid of the local mischief, and thus cut short the constitutional affection, by amputation. This has been chiefly advocated by Professor Fayrer of Calcutta, who says, “When the pulse quickens, and rigors occur—when the discharge begins to assume an ichorous and unhealthy character—when, on examination, the bone proves to be denuded of periosteum, and the medullary canal filled with dead bone or pus,—I am

satisfied that the sooner amputation at or above the next joint is had recourse to, the better is the chance of saving the patient's life. The danger is in waiting too long—long enough for the blood-poison or the capillary embolism to have brought about changes in the viscera which are the precursors, if not the cause of death. The proper time," he continues, "for amputation (or removal of the affected bone) in osteomyelitis is not difficult to determine, for it should be as soon as possible after ascertaining that the bone is so affected; and, as I have said, the diagnosis is to be made by the constitutional and local symptoms, and by passing a probe into the medulla of the bone. Should it impinge on healthy, bleeding medulla near the surface, you may, if the constitutional symptoms are not urgent, wait and see if nature will limit the suppuration, and throw off a ring of diseased bone." The remarks made above on the use of escharotics and of the cautery, apply still more forcibly to the proposal of amputation. Looking at Professor Fayrer's data, which are our guides to amputation, they are most unreliable. Rigors and a rapid pulse indicate some pyrexial condition, which may be a slight pneumonia, a bronchitis, or suppurative fever. But which of these affections is thus ushered in, cannot be determined at this stage. Again, how very commonly does the discharge appear quite healthy during almost the whole course of the suppurative fever! The surgeon, indeed, is astonished at the rapidity with which a stump heals, or a suppurating joint gets well, while the constitutional symptoms are markedly pyæmic. It is very seldom that the medullary canal of a bone is found "filled with dead bone or pus;" and even in the most advanced stage of suppurative fever, the medulla bleeds and looks florid and active. If the limb

is removed the local mischief is got rid of, but the patient is worse than before. His system has for the second time sustained a severe shock, and it has again to undergo a tedious reparative process. The disease is constitutional, not local.

Resumé.—As experience teaches, in the case of most other diseases, prevention is more efficient in the management of suppurative and puerperal fevers than cure. The patient should be carefully prepared for the operation, or for the accouchement, by the use of such means as are known to be of service in improving the general tone of the constitution. The digestive organs should be diligently cared for. If the appetite is impaired, tonics, as quinine, or better, the citrate of iron and quinine, should be prescribed; if there is dyspepsia, such remedies as bismuth, bicarbonate of soda, dilute hydrocyanic acid, and the like, will do good; if the liver is acting sluggishly, podophyllin, or an occasional small dose of calomel, will relieve this organ; and if the bowels are costive, they should be opened by purgatives, as the compound rhubarb pill, or the effervescent citrate of magnesia. It is of the greatest importance, moreover, before undertaking an operation, like that of the resection of a joint, or the excision of a tumour, that a very careful examination of the chest and of the urine be made; and the previous history of the patient, as regards illnesses from which he may have formerly suffered, should be carefully obtained. From knowledge of this kind the surgeon is guided in his daily inquiries after the operation. Doubtless, if any special organ has been the seat of disease during the earlier years of the patient's life, such an organ will be most liable to be secondarily affected after the operation. Another point to which

sufficient regard is not generally paid, especially among hospital patients, is, that the nervous system should be as effectually as possible braced up for the extra stress to which it is about to be exposed, and all influences which might in any way disturb it be removed. If pain is caused by the disease for the removal of which the operation is to be performed, or if it be sympathetic in the puerperal condition, opiates, and anodynes locally, should be prescribed. The diet of the patient is by no means an unimportant item in the prophylaxis of this disease. The patient should be accustomed to hospital regimen, and should receive only plain nourishing food. Stimulants should not be given, unless absolutely required to support the constitution; for, if they are not given at this period, they will be of more service when exhibited at a later stage. Daily exercise in the fresh air has a most beneficial effect in improving the health, and should not be neglected. As regards wounds, prophylactic treatment consists in the strictest attention to cleanliness. The dressings should not only be changed at least twice daily, if the amount of discharge from the wound is excessive; but it is advantageous to wash the wound with tepid water containing Condyl's fluid, and to apply charcoal poultices, if sloughing, especially of a gangrenous character, is present. After the operation or the delivery, attention should be still more carefully devoted to the above points.

When suppurative fever is pronounced, our sheet anchor consists in the free and early use of tonics, of stimulants, of nourishing and easily-digested food, and of opiates. In the cases I have narrated, quinine, tinctura ferri muriatis in large doses, and potassæ chloras administered as a drink, were prescribed in some in-

stances; while in others the remedial treatment of the fever consisted only in such means as are commonly employed to allay certain symptoms. Neither method could be preferred on the ground of diminishing the mortality which followed its employment. No doubt tonics served to improve the patient's appetite, thus supporting his strength, and deferring the fatal issue; but the disease continued its onward course without any apparent arrest. Tonics, then, should be administered in suppurative fever with the same object as when employed in other typhoid conditions of the system.

Various opinions are held on the use of stimulants in fevers as a class. Without discussing the whole question, my experience leads me to think that a plentiful exhibition of stimulants in suppurative fever is all-important. Carbonate of ammonia has often a magical effect in improving the patient's condition. Most of the instances of recovery from well-marked pyæmia have been attributed to the free use of wines and other stimulants. In milder cases, where the adynamic state is not developed, and in the case of young persons, moderation in the employment of wines and spirits, should be exercised. But when an adult is suffering from the discharge of an extensive wound; has the characteristic pyæmic tinge and hay-like odour of the breath, with laboured or impeded respiration, and a short dry cough; when he perspires profusely and has rigors,—by all means pour down stimulants. Brandy is generally acknowledged to be the best form of spirit to be given in such cases, though whisky is scarcely its inferior. Of the wines, sherry, champagne, and good port are the most useful. Champagne has sometimes a wonderfully beneficial action

in inspiriting patients when in a typhoid state ; and it can often be retained by the stomach, even when this organ is very irritable. Little requires to be said as to the kind and form of food which is best. Most surgeons at the present time have devoted more or less attention to this point ; and each has his favourite culinary preparation. One remark, however, is called for—that is, to avoid sameness, and to have as much variety as possible, both in the kind of meat, and in the form of its preparation. Further, the food should be given at regular intervals, and not indiscriminately at all hours. When the mouth is parched, the skin hot and dry, and the stomach very irritable, nothing is so much relished by the patient as ice. Next best to the sucking of ice, is the use of pleasantly acidulated effervescent draughts. Grapes, and other succulent fruits, are often very grateful to the patient. As a rule, nutritive food is, in cases attended by vomiting, best exhibited in a fluid form, such as strong soups or liquid extracts.

Lastly, among constitutional remedies may be mentioned opiates. It is of great importance that patients suffering from suppurative fever should sleep well. They are not kept awake by pain, as is the case in some other diseases ; but they are restless, and hence it is best to administer opiates in such instances, in small and frequent doses.

As to the local means of treating suppurative fever, the securing of cleanliness ought to be the chief aim. Amputation, escharotics, and the cauteries, all fail in cutting short the disease. And yet much may be done by paying strict attention to keep the wound clean ; by giving a free vent to discharges ; by the use of disinfectant lotions and poultices ; and by rest, in preventing the repeated production of the poison and its absorp-

tion. If sloughing, the wound should be touched gently with caustics. If gangrenous or foetid, escharoal poultices and like antiseptics should be employed. In all instances the wound should be washed and dressed with tepid water containing Condly's fluid. From time to time the alternate use of various lotions to the wound should be adopted.

Painful joints, or circumscribed seats of pain, require the use of anodyne fomentations.

When suppurative fever follows disease of the internal ear, it is generally owing to retention of the discharge within the mastoid cells, and to the advance of the disease from this point to the lateral sinus and the brain, instead of finding a free egress through the external meatus. "In such cases," says Toynbee, "if in any way a sufficient portion of the membrana tympani had been removed at the beginning of the attack, to permit a thorough evacuation of the contents of the mastoid cells, the bone would have remained free from the disease,"* and thus the supervention of suppurative fever would probably be prevented.

"There is no security against a relapse, and none against a recurrence, after a longer interval, of a similar or an allied affection, except in careful after-management of these cases," says Callander. Therefore, during convalescence from suppurative fever, the principles stated above ought not to be disregarded.

Tonics and stimulants should be persevered in, rest should be maintained, and the patient should be as diligently cared for during his tedious convalescence, and till he regains his usual strength, as when the systemic infection was most virulent.

* Toynbee, 1860, p. 321.

CHAPTER VII.

THE PATHOLOGY OF SUPPURATIVE FEVER.

THE most elaborate accounts we have of the anatomical lesions present in this disease are given by Velpeau, Castelnau and Ducrest, Sédillot, Lee, Callander, and Virchow. In fact, more attention has hitherto been paid by authors to the pathology than to the symptomatology of suppurative fever. The best means of examining the large amount of information now before us on this point, is to consider it under two heads:— (A.) The anatomical lesions found after death in the organs and tissues of patients who have died of suppurative fever, including the morbid appearances presented by the wound or stump after death. (B.) The pathological changes which the fluids of the body undergo in this disease. In suppurative fever (as in other fevers) the poisonous principle—*materies morbi*—occasionally induces death ere local lesions have had time to manifest themselves. No definite relation has been proved between the local lesions and the symptoms—that is, extensive pathological changes are often observed in cases of comparatively short duration; while in other instances in which the disease has pursued a lingering course over weeks or months, the secondary visceral deposits indicate an incipient form

of the affection. Further, diffuse and extensive organic lesions are often observed in viscera, which, judging from the symptoms present during life, were considered to be healthy; and *vice versâ*.

(A.) THE ANATOMICAL LESIONS—FOUND AFTER DEATH
IN THE ORGANS AND TISSUES.

The Pathological Appearances observed in connection with the Nervous System.—Secondary affections of the brain and spinal cord, or of their coverings, are not so frequently met with as those of the other organs, and they have been accordingly, as yet, very imperfectly described. Even though very severe nervous symptoms are present, the post-mortem appearances are in such cases often comparatively slight. From having met with a rapidly fatal case of erysipelas, in which the membranes were found after death to be chiefly inflamed, I conclude that the pathological changes observed were probably the same as those which occur in the early stages of suppurative fever. This patient was a boy, who, after receiving a wound on the forehead with a stone, died in consequence of the supervention of erysipelas. The post-mortem appearances were the following: The veins of the dura mater and the venous sinuses were engorged; the serous membrane was at various points adherent to the calvaria, and on its surface was a layer of recent lymph. Extravasations are most commonly met with on the surface of the brain, and they are generally circumscribed. In the above case, between the dura mater and the bone on the right side pus was effused; and this was

present also in the subarachnoid space of the same side. The arachnoid vessels, as well as those of the pia mater, were distended with blood. The fluid in the ventricular cavities was diminished in quantity. The ventricular and subarachnoid fluid is sometimes increased in amount (as in Case VI.) The vessels of the brain substance and of the membranes on the left side were (in the former case) also filled with blood ; but no lymph was poured out, nor pus formed on this side. The cerebral tissue of the right hemisphere was somewhat softened, but in other respects appeared healthy. Sometimes the nervous substance of the brain is congested and œdematous (as in Case VI.) Such, then,—congestion, extravasation, or diffuse purulent formation,—are the earlier pathological phenomena observed in cases of death from suppurative fever. At other times, however, the inflammatory products are circumscribed in the form of abscesses, like those met with so abundantly in the other viscera. Commencing as spots of congestion, having a red appearance, they assume a yellowish colour, and are soft like the patches which occur in cases of so-called “ embolism ” in the brain ; pus is next formed in their cavities, and they are developed into true abscesses, varying in size from that of a pea to that of a hen’s egg. The cerebral tissue is partly broken down by the destructive suppuration, but the glairy, greenish-yellow pus at the same time burrows amidst the convolutions, dissecting out their various layers, till the nervous substance hangs in shreds over the cavity formed. (See Plate V.) In such instances the whole cerebral substance is often so very soft, as not to admit of being handled. The choroid plexuses are not infrequently found devoid of blood (Case VI.)



PLATE V.

Represents the base of the cerebellum and adjacent parts from the patient J. B. (Case XII. Chap. III.). The whole cerebellum was very friable. The abscess is seen to have broken down a large portion of the right lobe of the cerebellum, and the remaining layers are to a great extent dissected from each other by the burrowing abscess. The contents of the cavity of the abscess consisted of unhealthy, greenish pus, with disintegrated portions of nervous substance.

H. Lee has thus described the pathological lesions found in the cranial cavity after death from pyæmia : “The brain and its membranes frequently present diseased appearances in those who die from secondary inflammation; these for the most part may be altogether independent of any peculiar effects of the disease; but, in some cases, it appears probable that they are not altogether unconnected with it. In one of the accompanying cases, the pons varolii and medulla oblongata were found of a pink colour, in consequence of congestion, where the system had become contaminated by the absorption of diseased secretion; and, in another, a layer of purulent lymph was found within the cavity of the arachnoid, accompanied by marks of inflammatory action in the fourth, and in one of the lateral ventricles.” *

These pathological changes are not limited to any special part of the brain; nor do they occur more frequently in the grey than in the white substance of the brain. In Case XVIII. the intercranial abscess occupied the immediate neighbourhood of the left meningeal veins. “The number of foci of disease present at one time,” says Bristowe, “varies very considerably; sometimes, not more than one or two are discovered; sometimes they are so numerous that scarcely any part of the brain, so large even as a chestnut, is found free from them.” †

The organs of special sense seldom call for examination. During life they are very rarely the seat of morbid symptoms, and the amount of trouble attendant on an examination of them after death, as well as the

* Lee. 1850, p. 56.

† Bristowe. 1866, p. 196.

unsatisfactory results generally furnished by such an inquiry, have doubtless been the chief reasons of these organs not having been so carefully investigated at autopsies as have been the lungs, liver, and kidneys. The eye is the organ of special sense most frequently attacked by suppuration. Arnott thus describes this affection of the eye: "There is redness of the conjunctiva, intolerance of light, and contracted pupil; rapidly followed by opacity of the cornea, and excessive chemosis. The eye ultimately sloughs, and its contents escape."* This organ is the seat of suppurative inflammation especially in cases of puerperal pyæmia.

The same argument as that employed to account for the diminutive number of recorded examinations of the eye, applies still more forcibly to the ear. The time and labour required in examining the ear, as well as the general absence during life of symptoms which would direct attention to this organ, account for the scarcity of evidence at present afforded concerning the pathological changes which occur in this organ in suppurative fever. The late Mr Toynbee, in his admirable treatise on "Diseases of the Ear," relates several cases of "purulent infection" following suppuration in the ear. "Cases of disease in the mastoid cells terminate fatally," he says, "from two different causes: 1st, From purulent infection, arising from the introduction of pus into the circulation through the lateral sinus. 2d, From disease of the cerebellum or its membranes. Cases of purulent infection," he further remarks, "have not been met with when the disease occurs in the

* Arnott, p. 121.

tympanic cavity." * Abercromby † and Watson ‡ have published similar cases, as also have Bruce (in the "Medical Times and Gazette"), Wilde § (in his work on the ear), and Gull || (in the "Guy's Hospital Reports"). The following case, furnished by my friend Dr Rawdon of Liverpool, and which occurred while these sheets were being composed, affords a good example of this source of suppurative fever.

J. A., aged eleven years, was admitted into the Infirmary with a "suppurating ear." The patient's father stated that, five days previously (Wednesday), he noticed a small quantity of watery discharge coming from the boy's left ear, but he showed no alarming symptoms. Two days later the boy was observed to be "poorly." He was feverish, his skin hot and dry, and he had some vomiting. He complained of soreness in his throat, and of a stiff neck. The affection was diagnosed by the medical attendant as scarlet fever. On the fifth day of illness, which was the day of admission into hospital, the boy had a rigor. There was no swelling or redness about the ear; but slight pain was complained of, and the watery discharge continued. He suffered also from great insomnia, and from frontal headache. Next day (Monday) another rigor was experienced; his skin and conjunctivæ assumed the characteristic pyæmic tinge; his pulse was rapid and irritable, and his tongue furred. The other symptoms remained much the same as formerly. Little altera-

* Toynbee. 1860, p. 313. † Abercromby. 1828, pp. 33, *et seq.*

‡ Watson. 1848, vol. ii. p. 324.

§ Wilde. 1853, p. 429, *et seq.*

|| Gull, in "Guy's Hospital Rep.," ser. iii. vol. iii. 1857, p. 279.

tion occurred during the week, except that the boy became weaker. On the thirteenth day of his illness (Sunday) a little redness was observed behind the left ear, descending the affected side of the neck. An incision was made at this point, which afforded relief, but evacuated no pus. The ashy-yellow colour of the skin was well marked, and insomnia was increased. Respirations were forty per minute. On testing the urine, no albumen was detectable at any time during the course of the illness. From this date onwards, the typhoid condition became more and more developed. The patient had slight "wandering," but not true delirium. He was conscious, so as to be able to recognise his relatives, till within the last few hours of his life, when he became insensible. He died on Wednesday. The absence of convulsions, or other nervous symptoms, was remarked as a striking phenomenon in this instance.

Pathological Appearances. — On examining the cranial cavity nothing abnormal was found till the left lateral sinus was reached. Here the dura mater was readily separable from the bone, and, in fact, at the part corresponding to the discoloured bone, it appeared to have been already separated. At the point where the left lateral sinus curves to join the internal jugular vein and as far as the point of junction of the two veins (that is, behind the petrous portion of the temporal bone), the lateral sinus was distended with a firm fibrinous clot; but the wall of the sinus, corresponding to the discoloured bone, was in a sphacelated state, and the vessel contained at this point a dirty greenish-yellow slough. (See Plate XII.) The small bones of the internal ear were absent, and all the cavities

were filled with a eurdy-looking material. The superior semieircular canal opened into the roof of the meatus by an irregular orifice of considerable size. The walls of the cavity of the semieircular canals were rough (earious), and their cavities dilated. Exeept at one point, at their inferior angle, the mastoid eells appeared to be normal, though the bone was discoloured; and at the point referred to was a small carious cavity filled with greenish matter of caseous eonsistenee. The right lung was eovered with reeent lymph. In both lungs there were numerous incipient secondary abscesses. There was also eireumseribed pneumonie hepatisation, espeeially in the upper lobes of both lungs; and in these portions the secondary abscesses were situated. In the right lung there was also observed the collapsed eavity of a secondary abscess, which appeared to have reeently burst outwards; and thus, probably, the eoneomitant pleurisy was exeited.

This ease confirms Toynbee's statement that, "the disease very insidiously progresses from the mastoid eells to the erebellum and lateral sinus, and proves that the sinus may become inflamed, purulent matter developed within it, and seeondary abseesses produeed, without the oeeurrenee of caries in the bone forming the 'sinus lateralis.'"^{*}

The contents of the spinal eanal are very seldom examined, and rarely exhibit any eharacteristie pathologieal lesion. The spinal eord was healthy, but the intraspinal veins were greatly engorged,—is the report in Case II. Chap. II. Among the twenty cases I have

^{*} Toynbee. 1860, p. 320.

recorded thirteen were examined after death. Of these thirteen, the cranium and its contents were examined in six instances. In only one of these six cases were the cranial contents healthy.

The Anatomical Lesions found in the Thorax.—The pericardium is rarely covered with recent lymph, as is found to be the case with the pleuræ. Sometimes the pericardial cavity contains a small amount of serum tinged with blood (as in Cases VI. and XII.) The heart itself occasionally contains incipient secondary abscesses. Its walls are not infrequently flabby; but the softening is of that kind which Laennec first described as being most observable in idiopathic (*i. e.* typhus) fever when the putrid symptoms were most marked. The cardiac cavities generally contain imperfectly coagulated blood. The muscular tissue of the heart, according to Bristowe, “is either infiltrated with some inflammatory exudation, or contains a cavity with pus,—the muscular fibres are devoid of striæ and filled with oil globules.”*

The pleuræ are generally inflamed in this disease, along with the pulmonary tissue proper. The costal and visceral layers are sometimes found firmly, even inseparably agglutinated together by old adhesions. They are, however, more commonly united by recently formed lymph, which covers more or less of their extent, and is easily broken down. Occasionally both sides of the chest, but generally one only, is the seat of this inflammatory process. The pleural cavities commonly contain some opaque, muddy, sero-purulent fluid mixed with blood and having masses of lymph floating in it.

* Bristowe. 1866, p. 193.

PLATE VI.

Represents a lung deeply congested and containing numerous secondary abscesses. The lung was removed from the patient J. H. (Case XVI. Chap. III.). Abscesses of various sizes are seen surrounded each by a zone of engorged vessels, well defined, and abutting almost abruptly on healthy pulmonary tissue. The incipient forms of abscess formation are indicated by bluish-white specks (like miliary tubercle), while the fully-developed abscesses present yellowish-white centres.



It is not improbable that this development of lymph on the surface of one or both lungs, and the agglutination of the pleural surfaces, serve to prevent the bursting of the secondary pulmonary abscesses into the pleural cavity—which rarely takes place.

The bronchial mucous membrane presents a bright pink colour, while its secretion, clear and frothy, is increased in amount. The same characters are observed when one examines the smaller ramifications of these tubes.

The pulmonary tissue proper is the most frequent seat of secondary purulent deposits. Here are observable all the characteristics shown by those purulent formations; and the pathological changes met with in this tissue have, accordingly, been most minutely examined by the older observers. The first changes which occur, in one or both lungs, are those commonly described by the term pneumonia. The pulmonary capillaries become congested, engorged, causing the so called "consolidation" of the lung tissue. The smaller vessels, trying to overcome this afflux of blood, may produce ecchymoses or extravasations beneath the lining membrane of the air vesicles; but these minute capillary congestions are generally observed as red points studded over the pulmonary surface, which by-and-by exhibit yellowish-white or bluish-white centres. While one part, generally the lower half of the lung, is thus hepatised, solid, and of a dark-greenish colour (see Plate VI.), the remainder of the lung is emphysematous, and more or less œdematous. (See Plate VII.) A section of the former presents the same appearance as is observed in the lungs of pneumonic patients. Whether these incipient abscesses are developed from the minute points of congestion

afore mentioned by the breaking down of some thrombic clot in their centres, or whether the pus is developed out of the serum exuded by the walls of the engorged capillaries, cannot be easily determined, and has as yet not been decided. These secondary abscesses vary in size from that of a hemp seed to that of a hen's egg. Sometimes they are of firm consistence, solid, concrete; but they generally contain pus or serum with caseous lumps, or masses of lymph, and broken down tissue floating in it. The minute points of congestion bear a striking similarity to one another in form and size, and correspond to single lobules. At first of a bright red colour, these incipient abscesses, after the blood has been for some time arrested in the lobule, become of a light-brown colour, then bluish-white, then yellow, and lastly assume a whitish-yellow, glistening appearance, with bulging and evidently purulent centres. They, in fact, pass through the same changes as clots in other tissues. They soften gradually and become diluent in their centres; and, immediately external to their circumference, is a red zone of congested vessels. They contain fatty granules, amorphous débris, disintegrating blood globules, and more or less perfectly formed pus corpuscles. Though this process is confined at first generally to one lobule, it by-and-by extends to the surrounding lobules; and, at last, either abscesses of tolerably firm consistence, and of the size of marbles, become developed, or cavities are formed. This last result was well exemplified in Case I. Chap. II., where, in the centre of the posterior half of the lower lobe of the left lung were two distinct cavities, lined by a very friable curdy-looking membrane, and containing portions of necrosed pulmonary tissue and very foetid pus partially

mixed with clotted blood. These vomieæ were of the size respectively of a hen's and of a pigeon's egg. Only a very thin film of tissue, apparently in a necrosed condition, separated the larger cavity from the pleural sac; but the cavities were, on their deeper aspect, surrounded by hepatised tissue.

The pus contained in such abscesses varies in quality, from being sanious, greenish, and of very foetid odour, to a glutinous, yellow, thick fluid, having the odour of well-formed pus. It generally contains masses of lymph or disorganised tissue, of either a tolerably tough consistence, or of a diffuent character. "At other times the whole collection has the character of softening tubercle." Further, the more rapidly these abscesses are developed, the better formed is the pus. In chronic cases their contents become by-and-by inspissated, and acquire a firm caseous consistence; or they may even undergo further degenerative processes.

Callander says the left lung is more commonly the seat of these pathological changes than the right one; while Savory holds the very opposite view. Among the thirteen cases, the autopsies of which I have narrated in a former chapter, secondary abscesses existed in the left lung in two instances; in the right lung in one instance; in both lungs in seven instances; while in two cases (XII. and XIV.) the lungs were diseased, but contained no purulent deposits; in one case the thorax was not examined. These secondary abscesses may be situated either superficially, or they may be imbedded deeply in the pulmonary tissue. They occur most frequently in the lower lobe. Dance drew attention to this feature as distinguishing purulent deposits from tubercles.

These pathological appearances, observed in the lungs

after death from suppurative fever, have been variously described by authors ; and their narratives are coloured by the theoretical views they hold of the nature of this disease. Velpeau, for example, compares the secondary abscesses found in the lungs to "encephaloid or tubercular tumours. Fluid and healthy pus is often found," he says, "in the centre of each mass ; at other times this liquid is bluish, and resembles serum, in which float caseous lumps ; in almost all, the matter becomes less and less liquid as you approach the circumference where it is generally quite concrete ; there it is often seen combining insensibly, but not intimately, with the organic tissue, which at some lines beyond re-assumes at once all the attributes of its healthy condition. Only the parts nearest to the abscess are generally filled with a large quantity of blackish blood and of serum. Some of these centres are also, but more rarely, under the form of a concrete mass, even in their centre, and then resemble, to a certain extent, true tubercles which are becoming softened."

"The globules of pus," says Sédillot, "are arrested in the lung tissue, and, accumulating there, have to be eliminated as foreign bodies. The globules cause ecchymosis by impeding the circulation, and emphysema by obstructing the passage of air. If these foreign bodies are not eliminated from mere little spots of ecchymosis, the tissue becomes gradually more and more hepatised, and the abscess it encloses increases in size. Moreover, as purulence is the distinguishing trait of pyæmia, so is gangrene of putrid infection." H. Lee, who believes in the phlebitic origin of pyæmia, thus describes the pathological changes which occur in the lungs : "The first appearance produced is that of one or more con-

gested or dilated veins of very small diameter. This will be followed by a well-defined spot, of much darker colour than the surrounding texture. Several of these spots will probably appear at the same time, and each one of them will soon become surrounded by a hard spherical patch of purple congestion. Effusion of lymph will now take place, commencing in the centre of each affected portion, and gradually extending towards its circumference. If the disease continue, each spot will suppurate, and the different parts will become softened and broken down, in the same order in which they were previously solidified.”*

Now, lastly, as to what becomes of these secondary visceral alterations induced by suppurative fever. “The mischief,” says Savory, “may fall short of suppuration. The morbid process, after reaching a certain point, may recede, and the patch of congestion, or the deep red or livid spot, instead of passing on into suppuration, may, after remaining for a while, clear up and gradually disappear.” When they become abscesses, they are surrounded by a halo of livid indurated substance, which gradually passes outwards into healthy tissue. Occasionally, when the local action of the poison seems to have been more intense, the portions of the structure affected do not pass into suppuration, but perish, and patches of gangrenous tissue are found after death. But do visceral abscesses ever heal, their contents being absorbed or eliminated by the system, and do their cavities cicatrize? Some affirm that these purulent deposits, even when they are well advanced, may be

* Lee. 1850, pp. 51 and 52.

got rid of, and that the ulcers they formed may granulate over. Because patients suffering under the most characteristic symptoms of pyæmia do sometimes, during convalescence, expectorate shreds of pulmonary tissue and purulent nummuli, some have supposed that the "*vis mediatrix naturæ*" used this means of emptying the abscesses, and getting rid of their deleterious contents, and that, thereafter, a reparative process commenced and progressed uninterruptedly. Others, with Callander, state that no satisfactory evidence can be brought forward to show that the progress of these abscesses is ever arrested, and repair or cicatrization commenced. "Their contents are never found thickened," he says, "drying up, as it were, with puckering and shrivelling of the surrounding tissue."* In order to decide this point, it will be necessary to watch cases of chronic suppurative fever which have recovered, and have died several years afterwards from other diseases. This means of investigation is chiefly in the power of private practitioners; and by publishing such cases they may render invaluable service to science.

In short, the characteristic pathological lesions observed in the lungs after death from suppurative fever, are circumscribed abscesses or collections of pus, with a firm circumference of congested vessels. These abscesses appear at first as well-defined points of congestion, limited originally to individual lobules, and by-and-by involving neighbouring ones. Such red spots present next a bluish-white or yellowish centre, indicating the formation of pus. The lungs are the organs most frequently involved; and these abscesses

* Callander, p. 277.

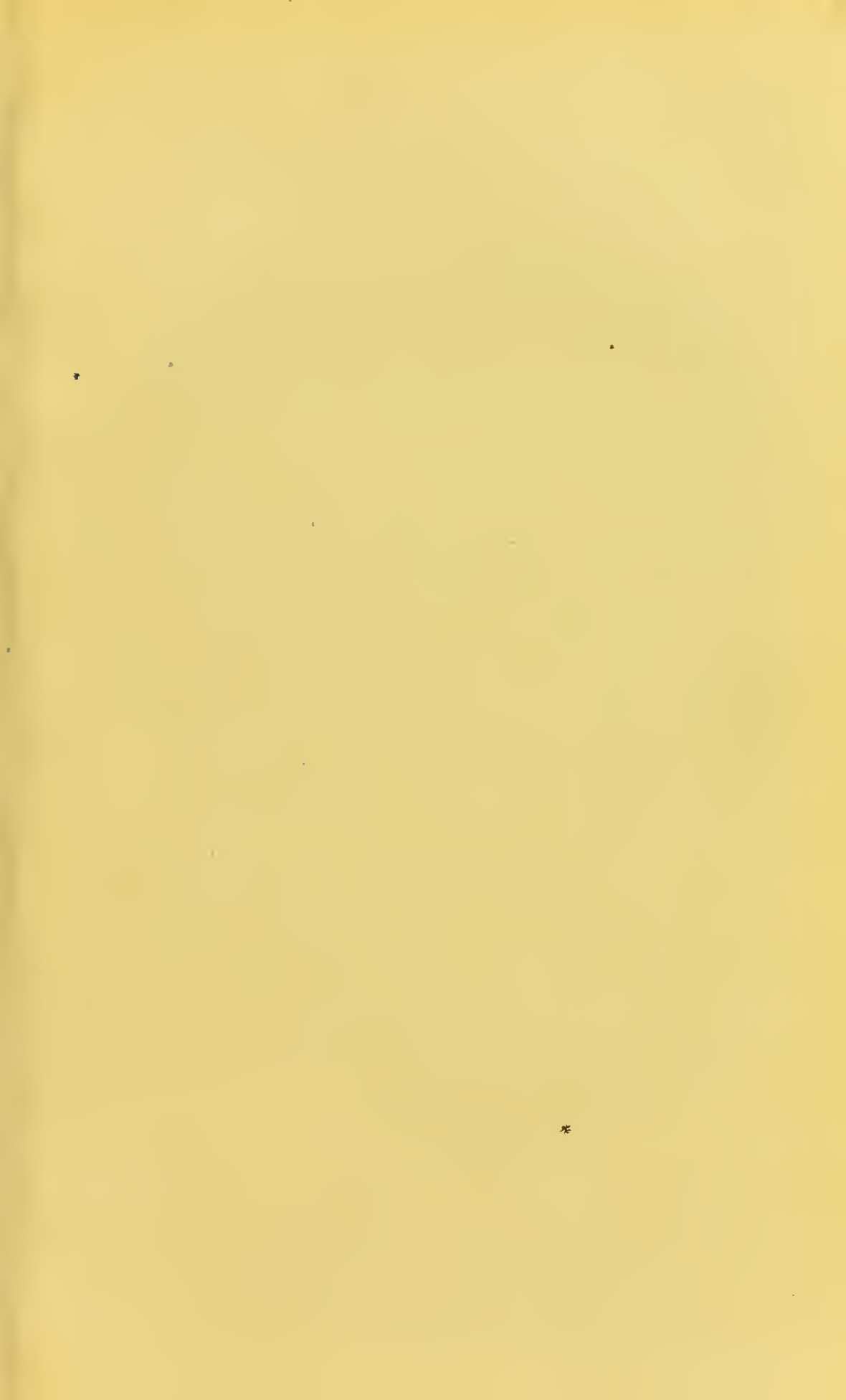


PLATE VII.

Represents another lung from the patient H. J. (Case VII. Chap. III.). The lung is congested and somewhat emphysematous. It contains several secondary abscesses of rapid development and of considerable size. An incision has been made into the organ, and we have here expressed the appearance of the pulmonary tissue, and of the abscesses on section. The whole lung was covered with recent lymph, and here and there on its surface are seen patches of this morbid tissue.





occur both on their surfaces and in their substance. (See Plate VII.) The surface of the lung thus affected is generally covered with recent lymph. These morbid changes, moreover, are frequently not accompanied by symptoms proportionate in their severity to the morbid alterations which are taking place. It may be added that the larger abscesses met with in the lungs, as well as in the other viscera, appear sometimes to be lined by a more or less perfect membrane.

Velpeau and others mention the occurrence of secondary submucous abscesses in the larynx and tonsils, and of pus in the nasal fossæ and frontal sinuses.

Anatomical Lesions met with in the Abdomen.—The liver is, next to the lungs, the most frequent seat of purulent deposit. Secondary abscesses of the liver, consequent on injuries of the head, had been remarked by surgeons at a very early date—long before metastatic deposits in other organs, as sequent on suppurative fever, were noted. The liver was more or less diseased in one half of the cases which I examined. In some it was simply enlarged; in others it bore evidence of undergoing fatty degeneration; its tissue was generally soft and friable; and in one instance (Case III.) it had a dark greenish hue, not the result of decomposition. Abscess formation in the hepatic tissue pursues much the same course as that which we have described as occurring in pulmonary tissue; but, in the case of the liver, it generally progresses more rapidly. Commencing with congestion, from overdistention of the portal vessels of a lobule, serum is exuded into the surrounding tissue—lymph becomes deposited, and softens—pus is formed—and thus an abscess is developed. The congestive areola, however, surrounding such an abscess, is

less defined than that observed in the lungs. Hepatic tissue is much more readily broken down than pulmonary tissue: hence the abscesses met with in this organ are of a much larger size than those which are generally found in the lungs. The contents of these spots consist, in the incipient stage, of fatty granules, amorphous débris, and hepatic cells undergoing fatty degeneration; but by-and-by they contain well-formed pus, or a very liquid "greyish," "bluish," or "blackish" fluid, in which float shreds of imperfectly-formed lymph and of disintegrating hepatic tissue. These abscesses sometimes contain a grumous liquid in their centres, while at their circumference this matter is concrete and firm. (See Plate VIII.) "Occasionally," says H. Lee, "the larger hepatic veins are inflamed, giving to the organ a mottled appearance like granite."*

"Before the abscess is confirmed," says Callander, "a very characteristic appearance is presented. A number of firm nodules of a yellowish colour are conspicuous; these are the occluded vessels representing the outer part of the lobules; around them is a pale grey jelly-like network enclosing them, as it were, and this is the surrounding effusion of lymph and serum. Even after the softening of the fibrine and the formation of pus, the abscess retains some traces of its origin; for, when the pus is washed away, a mass of tough tissue remains, in which can still be traced the skeleton of the lobules. As surrounding parts are involved, they pass through similar changes; so that in the same liver may be seen fibrinous plugs, lobules with lymph effused around, and abscesses of varying size, in

* Lee. 1850, p. 52.



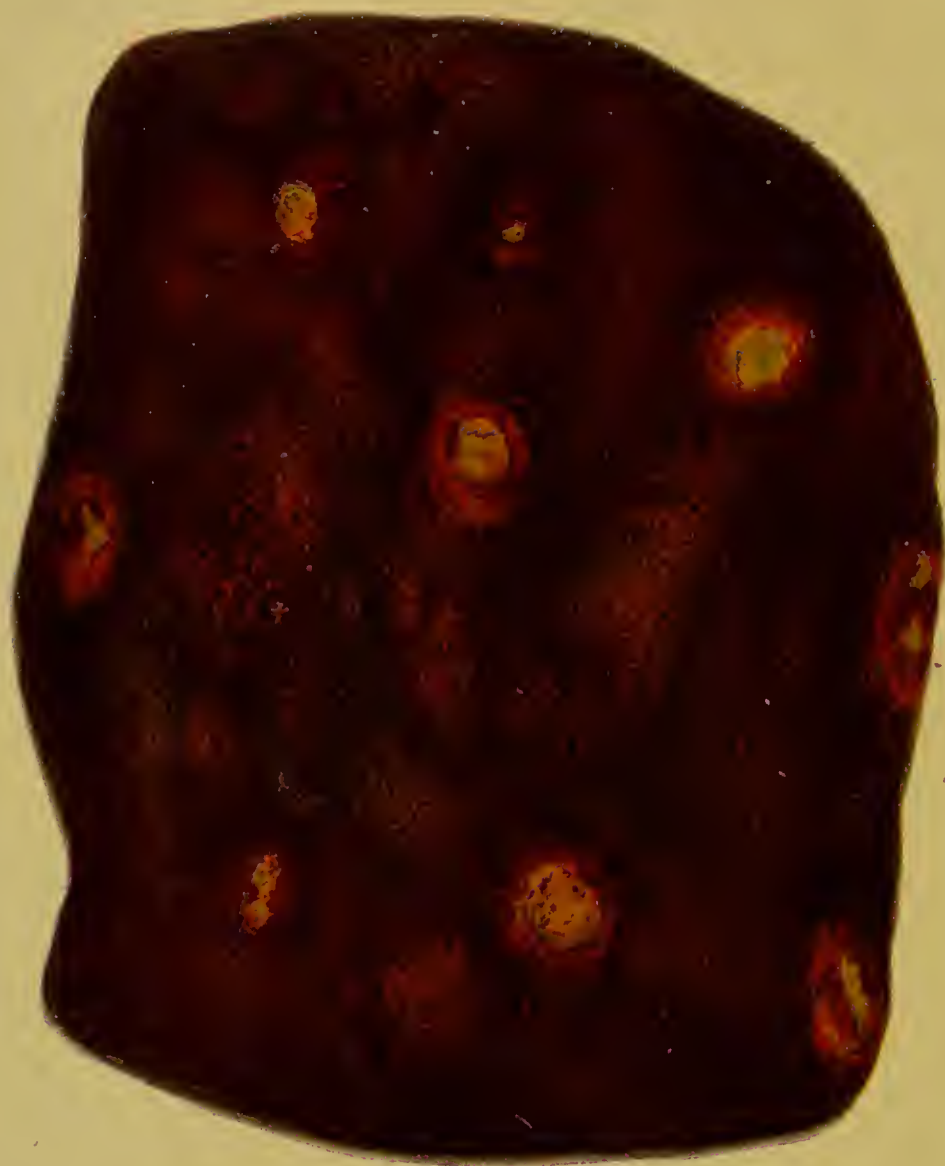


PLATE VIII.

Represents a section of a liver in which are embedded secondary abscesses. The surrounding hepatic substance is seen to be greatly congested ; while the abscesses themselves exhibit the same characters as in the other viscera, viz., yellowish centres surrounded each by a vascular zone.

their turn bordered by exudation materials, for no distinct wall invests them.”* If the diffusion is arrested, however, a wall of organisable lymph is formed, and this sometimes becomes thick and membranous. Sometimes, as in the case of secondary pulmonary abscesses, the contents of the secondary hepatic abscesses thicken and begin to dry up, but the curative process rarely if ever proceeds far, being arrested at this stage by the death of the patient.

Occasionally these secondary abscesses are met with in the liver when none are found in the lungs or elsewhere. Frerichs asserts that “the bile ducts are open, and usually pour out a little thin secretion, and that the organ itself is in most cases anæmic and dry.”†

Velpeau thus describes the purulent collections met with in the liver after death from pyæmia: “Some, indeed, present a softened and almost liquid point in their centre, but are grumous and more and more solid in proportion as you remove from this point, so as at the moment to be confounded with the hepatic tissue, to which they adhere generally very strongly—their substance being so compact as to be with difficulty crushed under the finger. Others present the same consistency throughout, and then they are either grumous like the first, that is to say, formed of caseous material, and constituted so that it is easy to see that this substance is nothing else than concrete pus; or else formed of masses, more or less regularly rounded, homogeneous, more consistent, presenting a regular outline of a white or yellowish colour, especially as you

* Callander, p. 278.

† Frerichs. “Clinical Treatise on Diseases of the Liver.” Sydenham Society Translation, vol. i. p. 162.

approach the circumference. All are perfectly circumscribed, and as if sown here and there in the parenchyma of the organ, which otherwise appears very healthy, even at the points nearest to these pathological productions."

The renal organs are very frequently affected secondarily in cases of suppurative fever. They present much the same train of anatomical lesions as those we have just described. The purulent formations present in the kidneys are either very minute, appearing as whitish-yellow points in the centre of a congested spot of the size of an hemp seed; or they are well-marked, circumscribed abscesses of the size of beans. They generally assume a linear arrangement, perpendicular to the surface of the kidney.

The capsule of the kidney is generally healthy and readily separable from the surface of the organ. The surface of the kidney, in the advanced stage of the disease, is puckered, of a purplish-red colour, and studded over with yellowish-white patches, surrounded each by a zone of congested vessels, and varying in size. (See Plate IX.) On section, the organ appears swollen, œdematous, flabby, and seemingly engorged with blood. It is larger than normal. Its pelvis is sometimes much dilated; and its ureter is much thickened, and increased in calibre.

Beckman has paid special attention to the changes which occur in the kidney during suppurative fever, and he has arrived at the conclusion that secondary abscesses in this viscus originate in the plugging of the capillaries.

The situation of these purulent deposits is varied. They generally occur in the cortical substance; which leads to the supposition that the Malpighian bodies are first affected, and that the earlier pathological changes



PLATE IX.

Represents a kidney containing secondary abscesses, which are seen both on section and on its surface. The surface view exhibits the peculiar puckering exhibited by this organ when thus affected, and shows the abscesses projecting superficially and bulging outwards. On section the secondary renal abscesses are seen to occupy, for the most part, the medullary portion of the viscus. The abscesses are not of large size, and are distinctly circumscribed. The kidney was removed from the patient C. S. (Case XIII. Chap. III.). The pyramidal portion of the organ is well marked and greatly congested.



occur in them, as they do in the lobules of the lung and of the liver. But these secondary abscesses are occasionally met with in the medullary substance of the kidney. The phenomena which indicate the incipient stage of the renal affection, are not distinguishable from those met with in the same organs after death from many other diseases. Moreover, the pathological lesions observed in the kidneys after death from suppurative fever, do in no regular measure correspond to the symptoms present during life. For example, in Case XVI., though granular casts, and even pus corpuscles, were detected in the urine during life, the kidneys at the autopsy were "healthy in appearance." "Deposits of lymph," says H. Lee, "are sometimes met with in the kidneys; but these are of small extent, of a light colour, and resemble lymph deposited in consequence of ordinary inflammation. In cases where purulent infection of the blood has been purposely produced, portions of the kidney will not infrequently be found inflamed and firmer than natural; but if the origin of the disease were not known, these appearances could not be distinguished from those produced by inflammation of the kidney from other causes."* Bristowe considers, on the contrary, that the formation of pus in these secondary renal abscesses takes place "originally, at least, in the intertubular tissue; and that very often in the early stages the Malpighian bodies and tubules in the affected spot are quite healthy."† I think this observation is incorrect. In those instances which have come under my notice, the secondary renal abscesses were met with chiefly in the cortical portion of the kidneys, and oc-

* Lee. 1850, p. 53.

† Bristowe. 1860, p. 195.

cupied the sites of the Malpighian corpuscles. It is rarely, therefore, I imagine, that the intertubular tissue is primarily affected in this disease.

Next to the kidneys the spleen is the most frequent seat of these secondary purulent deposits. This organ is observed after death to be enlarged, congested, soft, and friable ; as is also the case in many forms of fever. Among the cases I have recorded, the spleen was in six instances the seat of secondary abscesses. These appear at first as bright-red or brownish-red points of congestion. (See Plate X.) They are often well defined ; sometimes, however, they are irregular in form and of a "chocolate colour," while the surrounding tissue is pulpy. They generally occur in the medullary substance of the organ, and the capsule of the spleen is rarely implicated. They have been noticed also by H. Lee, who considers secondary abscesses in the spleen to be of rare occurrence. In some instances these splenic abscesses present distinct whitish or yellowish-white centres. Bristowe says, "They consist generally either of circumscribed extravasations of blood, or of fibrinous 'blocks,' which are both often of considerable size. The 'apoplectic' clots tend to become decolorised at the surface and to break down variously into a puriform pulp ; the fibrinous blocks are usually softer and more juicy than those of heart disease, and tend, like the clots, to liquefy. Distinct abscesses, too, of various size, are often secreted throughout the organ."*

"In the accompanying table," says H. Lee, "containing twenty-three cases, some morbid appearances, not recognised as peculiarly the result of secondary

* Bristowe. 1866, p. 195.

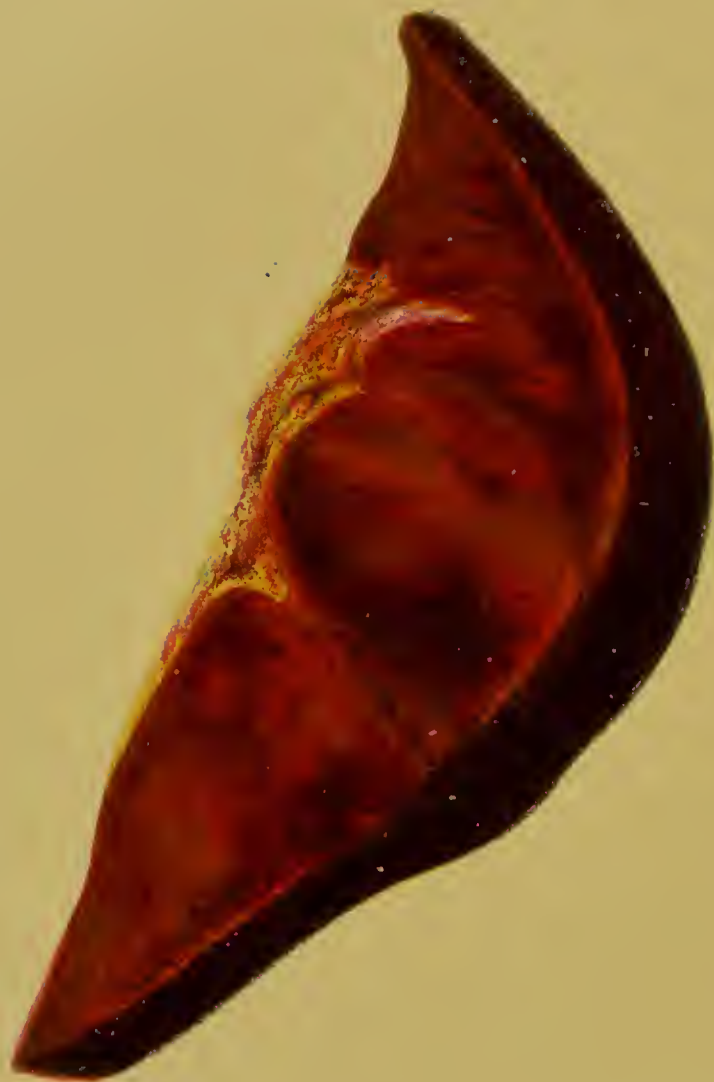


PLATE X.

Represents a section of the spleen removed from the patient J. H. (Case XV. Chap. III.). It illustrates well the congestive stage of secondary abscess formation. Near the circumference of the medullary portion of the organ are seen two brownish-red patches consisting of engorged vessels. The whole organ was very vascular and friable.

inflammation, were observed in the spleen in no less than eight instances. So large a proportion of cases renders it probable that the alterations observed have more than an accidental connexion with the disease of which the patient died, although they presented no characters which could be said to be peculiar to that disease." *

Dance has recorded the enlarged and softened condition of the spleen in this disease. "The spleen," remarks Virchow, "is a remarkably sensitive organ, which swells not only in intermittent and typhoid fever, but also in most other processes in which noxious, infectant matters have been freely taken up into the blood."

The rapidity with which the secondary abscesses found in this organ lose their original character after death, accounts for their being comparatively seldom observed in post-mortem examinations, especially if they are only in the incipient congestive stage of development.

White softenings have been noted in the stomach and in the intestines. Submucous abscesses have also been met with in the œsophagus, stomach, intestines (great and small); and they have occasionally been discovered in the ulcerative stage. The large intestine seems to be more frequently affected secondarily in suppurative fever than the lesser intestine. In Cases IV., XIII., and XVI. the large intestine showed circumscribed patches of congestion. Commencing, like secondary abscesses in other viscera, by a circumscribed congestion, ecchymosis, or petechial extravasation, which by-and-by suppurates, such abscesses in the intestines tend to ulcerate. These ulcers are situated with their

* Lec. 1850, pp. 52, 53.

long diameters across the axis of the canal ; they have bright red edges, and are irregularly emarginated. "Small ulcers, each about the diameter of a pea, abrupt at the edges, and penetrating the mucous and muscular coats, situated at the smaller curvation of the stomach near the pylorus," have been described by Travers.*

In the gastro-intestinal tract, and more especially in that part of it which belongs to the cæcum and colon, Bristowe has met with patches of granular exudation. "Occasionally, too," he remarks, "the intestinal sub-mucous tissue becomes the seat of well-marked pyæmic deposits, which may lead to the destruction of the mucous surface over them, and the production of a sloughy ulcer."†

"In two of the instances," recorded by Lee, "the lining membrane of the rectum was found of a very dark colour, and in one it had assumed a greenish appearance. This discoloration was at first looked upon as some accidental complication, or as depending upon previous disease ; but M. Gaspard has noticed a similar condition after the artificial introduction of putrid fluid into the blood. In one of the experiments referred to, the mucous membrane of the intestine was everywhere healthy except in the rectum and duodenum. In the former situation the rugæ were prominent, and of a violet colour ; in the latter, the membrane was of the colour of pale lees of wine."‡ Murchison states that "in pyæmia, as in cholera, variola, scarlatina, and erysipelas, the solitary and agminated glands of Peyer are occasionally found slightly thickened and elevated ;"

* Travers. 1835, p. 40.

† Bristowe. 1866, p. 195.

‡ Lee. 1850, p. 55.

but this "is not accompanied by enlargement of the mesenteric glands."*

I have met with no instances of secondary affection of the peritoneum in those who have died of suppurative fever. Some authors have, however, noted such an affection of this membrane. The peritoneum has been observed in these cases to have a peculiar dark grey appearance, and to present in some places minute nodular elevations, which might be little knobs of thickened serous membrane, or more probably circumscribed deposits of lymph. These characters were generally best marked in the vicinity of the cæcum and rectovesical pouch. "Submucous extravasations of blood are common," says Bristowe.† "In the peritoneal cavity," says H. Lee, "large quantities of unorganised lymph are frequently poured out, mixed with turbid serum or pus."‡

When there is abscess formation in the liver (as in Case XII.), especially if such a collection empties itself inwards, the surrounding peritoneum is generally implicated; circumscribed peritonitis is excited, and lymph deposited. The lymph formed under such circumstances, however, possesses an adhesive nature; and if the patient lives, it tends to limit the pus which is afterwards developed.

The Anatomical Lesions found among the Pelvic Viscera.—The mucous membrane of the bladder sometimes exhibits small ecchymoses on its surface (as in Case I.) Rarely, however, are ulcerations found in this viscus; and I have met with no record of secondary abscess formation in this organ.

* Murchison. 1862, p. 552.

† Bristowe, p. 196.

‡ Lee, p. 56.

The prostate is not infrequently the seat of purulent formations in cases of suppurative fever. Gamgee states that he has observed this lesion in three instances. But, seeing this organ is seldom examined at autopsies, it is probable that it is more frequently affected than is ordinarily supposed. Bristowe observes, that of all the pelvic organs "the prostate and the testicle probably most often undergo suppuration."*

The female organs of reproduction are commonly implicated in the pathological lesions found after death from puerperal fever, but abscess formation in these viscera is of rare occurrence. I have met with no mention of secondary purulent deposits having been observed in the uterus, vagina, or ovaries of pyæmic patients.

Morbid Anatomy of the Skin and Cellular Tissue.—As formerly stated, the dusky icteric tinge of the skin is one of the most characteristic and constant symptoms of suppurative fever. Virchow considers this tinge to be due to catarrhal icterus originating in the intestinal portion of the ductus choledochus; and he says it is also met with in pneumonia, in typhus, and in phosphorus poisoning.† Frerichs remarks, that to all appearance the jaundice is here the result of an impaired consumption of bile in the blood, arising from an abnormal condition of the metamorphic processes which go on in that fluid.‡ Bristowe states that bile pigment has been recognised in the urine, in the

* Bristowe. 1866, p. 196.

† Virchow, in "Virchow's Archives," xxxii. lft. i. 1865.

‡ Frerichs. "Clinical Treatise on Diseases of the Liver." Translated by the Sydenham Society. Vol. ii. pp. 113, *et seq.*

scum of the blood, and in the effusions into serous cavities in cases of pyæmia.*

Besides the almost invariable occurrence of this discoloration, the skin sometimes exhibits sudamina, or small circumscribed ecchymoses, or purpuric-like patches. During the early stage of the disease, the neighbourhood of a wound or part of a limb often assumes a bright red hue like that in erysipelas. It differs, however, from the latter, and is probably a temporary congestion of superficial cutaneous vessels which afterwards become blocked up. H. Lee has recorded three conditions of the integument in pyæmic cases, viz., "1. A pustular eruption resembling that of small-pox. 2. Irregular spots of congestion of a dusky colour. 3. Congested patches, darkest in their centres, rapidly passing into mortification, usually with extension of the congestion to parts around, though sometimes limited by a line of demarcation."† Velpau remarks that the skin in pyæmia "presents a yellow icteric tinge, livid spots, gangrenous patches, pustules, purulent bullæ, and lastly, true cutaneous abscesses in the thickness itself of the skin, and resembling carbuncles. The icteric tinge of the skin is dull, livid, greyish; it continues after death, and gives the body a hideous appearance."

The subcutaneous cellular tissue is often the seat of diffuse suppuration in pyæmia. The pus formed is generally unhealthy and foetid. It burrows about, and forms large projections of an irregular form. These purulent collections sometimes attain an enormous size, and they are situated in the trunk as well as in the

* Bristowe. 1866, p. 216.

† Lee. 1850, pp. 53, 54.

limbs. They are in some instances superficial ; in others, deep seated. Sometimes they form isolated, circumscribed abscesses ; while in other cases they are diffuse purulent infiltrations of the subcutaneous tissue of a limb, causing it to resemble a sponge saturated with pus. The pus is often mixed with serum and with lymph. The lymph effused in such localities is not adhesive and healthy material which might form a boundary to the disorganising process.

The edges of a wound, after death from suppurative fever, are of a blackish-green colour, like that of sphacelated tissue. Sometimes a dirty-yellow, sloughy-looking margin is present. The granulations are protuberant, of a pale grey colour, and glazed looking. There is usually no discharge before death ; and the surface of the wound looks dried up.

Morbid Anatomy of the Muscles.—The muscles are frequently found infiltrated with pus. Abscesses situated in muscles are limited by the intramuscular fasciæ, and so they burrow in among the muscular fasciculi. The primary congestive stage is never observed in this tissue, seeing it passes rapidly into that of suppuration. Muscles, which have undergone suppurative changes, appear after death of a pale brown, or dirty greenish-yellow colour, like flesh which has been macerated for some days in water. Secondary purulent deposits are most frequently met with in the muscles of the extremities ; sometimes in those of the trunk, of the diaphragm, and even in the muscular wall of the heart. Bristowe remarks that these morbid changes “(pyæmic abscesses) have been met with in the tongue.”* Such abscesses pass rapidly

* Bristowe. 1866, p. 197.

into the suppurative state, and therefore do not present any well-defined margin or wall of congestion. In some instances portions of muscles are thus degenerated, soft, and pultaceous, and form patches which are surrounded by perfectly healthy muscle. Nélaton says that, in muscles thus affected, the fibres are sharply cut around the pus-containing cavity, which appears to be the result of the softening down into pus of the fibres amidst which it exists. The pus is comparatively seldom collected into circumscribed cavities, but is generally diffused pretty uniformly through the interfascicular cellular tissue, without the least tendency to circumscription, much less to the formation of a cavity. H. Lee remarks, that "pus is occasionally deposited on the exterior of muscles; and it will be then smeared over the surface, and rather infiltrated into the cellular tissue than contained in a cyst."* When abscesses occur in the substance of muscles they are generally limited, not by lymph, but by the compact structure of this tissue.

I agree with Gamgee in thinking that muscles are not infrequently the seat of secondary abscesses. That abscesses have been comparatively seldom noticed in the muscles is ascribable rather to imperfect observation. In some instances their origin is traceable to sympathetic irritation excited by contiguity to or continuity with an inflamed part; but, in other instances, (as in Case IV.), secondary muscular abscesses are referable to the same source as those found in other organs. The formation of pus in muscles rarely gives

* Lee. 1850, p. 56.

rise to symptoms which attract attention to the local lesions ; and thus the latter are, no doubt, frequently overlooked in post-mortem examinations.

According to Savory, secondary purulent collections occasionally occur in the sheaths of tendons.

Morbid Anatomy of the Bones.—Bone being, as a rule, more commonly than any other tissue in the immediate vicinity of suppurative action, is almost always the seat of pathological changes in suppurative fever. Such lesions are not, however, characteristic of this disease, and are ascribable rather to the typhoid condition of the constitution and to the want of natural vigour in the system, than to any special morbid agent.

The periosteum is found, after death from suppurative fever, thickened and readily separable ; or if the bone has been exposed during life, the periosteum is absent altogether. On microscopical examination the periosteal covering is found infiltrated with pus ; that is to say, its fibres enclose pus corpuscles in their meshes. Occasionally an accumulation of foetid, sanious pus is found situated between the periosteum and bone.

The surface of bones—for example, in stumps or in the wounds of compound fractures—is generally bare, dry, and of a greenish colour. Bones exhibit either superficial caries or commencing necrosis, while in other cases the whole thickness of the “compact” tissue is perforated in a honeycomb-like manner by minute cavities, filled with thickish pus or caseous matter of a pinkish-white colour. The most important pathological changes are met with, however, in the cancellated tissue and medullary canals of bones. The whole of the phenomena we have already detailed, from

PLATE XI.

Represents a section of the head and of the shaft of the tibia, from the patient J. M. (Case XI. Chap. III.). The periosteum is seen to be thickened and readily separable from the shaft of the bone. The medullary tissue of the shaft is observed to have been broken down by the suppurative process, so as to compose cavities containing greenish-yellow and ill-formed pus. The cancellated tissue of the head of the tibia is seen to be greatly congested; while the cavities of the Haversian canals are considerably dilated, and their septa are at various points disintegrated. Some of the cavities thus formed appear filled with extravasated blood. This plate illustrates well the various stages of osteomyelitis, or secondary abscess formation in bone.





their primary stage of congestion till abscesses are fully formed, can be studied in bones. As formerly remarked in the case of the viscera, the primary alterations observed in the bones are those of congestion and dilatation of the Haversian canals. The section of a bone thus affected presents a bright-red, or brownish-red colour, while the cancellæ and larger Haversian canals are enlarged and have thin walls. By-and-by pus is formed. (See Plate XI.) The pus found in bones possesses the usual sanious character of unhealthy inflammation ; and, through its softening or macerating qualities, leads to the disintegration of the osseous septa between the Haversian canals and to the formation of cavities. The contents of these cavities consist of diffuent ill-formed pus, having a very offensive odour. Suppuration attacks the diploë of flat bones (like those of the skull), as well as the medullæ of long and cylindrical bones.

Special attention has recently been directed to the pathological changes that bones undergo in suppurative fever, with the view of tracing to this source the origin of the disease. Hence we have Professor Fayrer of Calcutta, and others, ascribing pyæmia to osteomyelitis, and recommending amputation as a cure. Fayrer states that of fifteen patients (out of twenty-nine) who died after amputation, in nine cases death resulted from pyæmia, the consequence of osteomyelitis ; and in three, from pyæmia not the result of bone disease. This is a larger proportion than is met with in this country. He further mentions an instance of osteomyelitis of the cranial bones.* Velpeau considered

* Professor Fayrer in the "Lancet," Sept. 7th, 1867.

that the bones were sometimes the points in which general purulent infection originated, and that their veins were then the seats of phlebitis.

To sum up,—the chief morbid alterations met with in the bones, are, congestion, dilatation of the Haversian canals, and cancellated tissue, leading to abscess formation and the excavation of cavities by the unhealthy pus.

Pathological Lesions presented by the Joints.—One of the chief characteristics of suppurative fever is the secondary affection of the joints. The early stages of these pathological changes are not often recognisable after death. They consist of intense congestion of the synovial membrane, and of increase of the synovial secretion, causing pain and stiffness, but not appreciable swelling of the joint. By-and-by pus is formed in the synovial cavity, and, attacking its softer contents, produces ulceration of the cartilage of incrustation, and disintegration of the synovial membrane and of ligaments, such as the cotyloid ligament of the hip-joint. The capsule becomes thickened from the infiltration of lymph and pus. The cartilage of incrustation is next separated from the bone, leaving a rough, carious surface; the soft tissues of the joint become liquefied, and are no longer distinguishable, and the articular cavity is distended with pus. Occasionally a joint is found, after death, filled with pus without exhibiting any other morbid alteration. “The cartilages may be in part destroyed and eroded,” says Velpeau, “the synovial membrane and ligaments pierced, without the contiguous parts having lost any of their suppleness or natural colour.”

Arnott regards the disease of the joints in pyæmia

to be "connected with inflammation and suppuration of the veins of the part which had been the seat of mechanical injury." These secondary articular abscesses are mentioned also by Castelnau and Ducrest, and by Callander.* Savory says that "this affection of the joints is usually during life the most striking and distressing of the local effects" of pyæmia. "It is astonishing," he continues, "with what rapidity pus will be poured forth into a joint under these circumstances, and it not infrequently happens, when, after death, the joint is carefully examined—a large quantity of pus having been washed out—that only very slight traces of any morbid action can be discovered. Here and there, perhaps, may be discerned some increased vascularity, and probably some thickening, but the synovial membrane, although it may be somewhat pulpy, will be entire, and no amount of mischief can be detected commensurate with the large quantity of matter which has been formed." "All joints, small as well as large," observes Bristowe, "are liable to be affected."†

This pathological lesion (which some consider to be diagnostic) consists in an extensive formation of pus in one or more of the joints, followed by softening and disintegration of the synovial and ligamentous structures in the articulation, with ulceration of the cartilage of incrustation and caries of the subjacent articular osseous surface.

Morbid Anatomy of the Glandular System.—The lymphatic glands are sometimes found secondarily affected in suppurative fever, but rarely, compared with the other tissues. The changes they present

* Callander, p. 279.

† Bristowe, p. 197.

consist at first of increased vascularity, causing swelling and induration. Lymph is next formed, and pus is soon developed in their substance. This suppurative condition of the glands was observed in Case XIV. These glandular abscesses early attracted the attention of observers, and they were by some considered to be analogous to those which occur in syphilis, scrofula, and other constitutional affections. This analogy is proved, however, to be incorrect by such abscesses being only occasionally met with after death from suppurative fever, and by their situation indicating clearly that they have the same origin as the various visceral abscesses commonly met with in this disease.

The lymphatic vessels, as well as the arteries and veins, have been conceived by some observers to be the channels through which the absorption of pus, or of morbid matter in pyæmia, takes place. They do sometimes contain pus; and at other times they exhibit signs of incipient angeioleucitis. Velpeau says that "suppuration of the lymphatic vessels may present itself under different conditions; they may be the seat of an incipient inflammation, and it will be principally in the cellular sheath which surrounds them that a very distinct vascular injection with serous or serosanguinolent infiltration is observable; sometimes their walls and cavity show no alteration; at other times they are much more voluminous than in their natural condition. They present occasionally the form of a chaplet, because of the alternate dilatations and contractions of their canal; in such cases their walls will be more friable, thicker, either of a red or gray colour, and their cavity will contain either pus, or a purulent liquid, or membranous grayish clots resembling coagulated

lymph." These clots, according to Tessier, at the edges of the local inflammation, obliterate the cavities of the lymphatic vessels. Velpeau further remarks that suppuration of the lymphatic vessels is observed principally after wounds, dissection wounds, ulcers of the legs, excoriation of the feet, and the like. He also states that the lymphatic glands may be in a state of suppuration without any of the lymphatic vessels presenting traces of inflammation, and *vice versa*.

The Anatomical Lesions presented by the Blood-Vessels.—When examined after death, the arteries are almost always found empty. They occasionally contain a little fluid blood, or a small quantity of purulent-looking fluid, or of blood having the appearance of water in which meat has been washed. The surrounding cellular tissue within the vascular sheath is frequently infiltrated with lymph, binding down the vessels; and the walls of the arteries are in some instances thickened, while in others they present a bright-pinkish or rose-coloured tinge. When the arteries of a stump are examined, they generally contain firm, healthy-looking fibrinous clots.

Under the impression that the veins furnish the source of the systemic condition termed pyæmia, very considerable attention has been devoted by many pathologists to the appearances presented by these vessels after death from suppurative fever. Some, led away by the theory that phlebitis is always the premonitory stage of this disease, have interpreted their observations accordingly. They have endeavoured to find clots invariably in veins, and, for the most part, pus or purulent fluid in the centres of these clots; while others have striven to demonstrate an invariable connection

between such clots or thromboses and the local congestions or abscesses, which are the characteristic pathological lesions observed in suppurative fever.

The anatomical changes presented by the veins after death are the following:—They are frequently filled, even distended, with firm, fibrinous clots; and they possess a cord-like feel on being handled. Their walls are generally healthy, but they are occasionally found (on microscopical examination) to enclose pus corpuscles or lymph in their fibrous net-work. When thus infiltrated, the walls of the veins are thickened and indurated (as was observed in Case XIV.) The lining membrane of the veins has generally a healthy appearance, but it is sometimes congested (as in Case XIV.) A portion of the wall of a vein may occasionally be seen to ulcerate and slough at one point. While the rest of the vessel in the neighbourhood of this point is filled with a firm, fibrinous clot, the vein opposite to the sphacelated portion contains dirty, thickish, greenish-yellow fluid. (See Plate XII.) The clots met with in the veins are sometimes firm, at other times broken down. To this latter condition is the thrombic origin of the secondary visceral abscesses referred by some pathologists. Though firm for the most part, and perhaps even surrounded by a thin membrane or sheath, these venous clots are observed in some instances to be more or less softened in their centres, this softening advancing either to partial or to complete liquefaction. This liquid (in the centre of venous clots) has either a puriform appearance, or is cream-coloured, like softened tubercle. Notwithstanding the occurrence of these changes in the clot, the lining membrane of the vein looks healthy. Venous clots vary greatly in

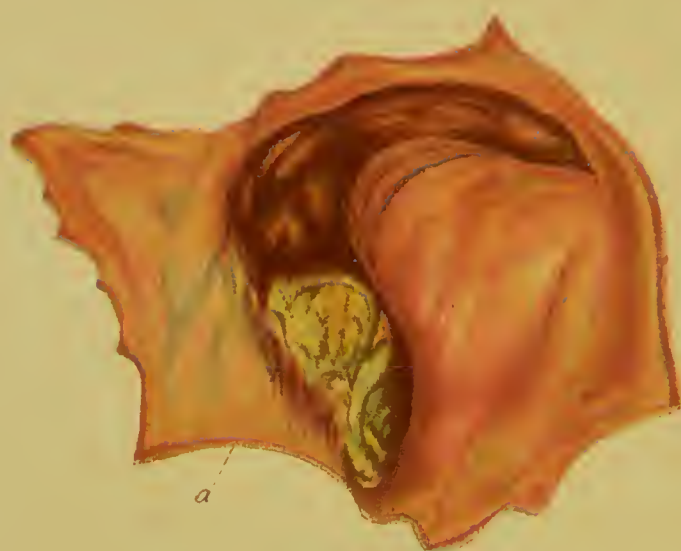


PLATE XII.

Represents that portion of the lateral sinus which joins the internal jugular vein. The original specimen was obtained from the patient whose case is narrated at p. 169, Chap. VII. ; and who died of suppurative fever sequent on disease of the internal ear. The vessel is seen to be filled with a well-formed coagulum, which near the point of junction of the two veins has become the seat of an abscess. At this point the centre of the clot has first softened, and then been transformed into pus. Ulceration of the wall of the sinus is also to be observed, while its cavity is filled at this spot with dirty, greenish-yellow pus.



length, extending to three quarters of an inch, an inch and a half, or more; and the coagulum in the main trunk of a vein is often connected intimately with the coagula in the neighbouring branches. Such a clot occurring in the pulmonary artery has not infrequently been observed to extend into the minutest ramifications of that vessel, so that, on incising the corresponding lung, diminutive clots are seen projecting from its smallest branches. Coagula will be observed most frequently to be best developed, or to exist alone, at those portions of veins which are furnished with valves, or at points where branches join the larger vein. These obstructions, in the abnormally coagulable state of the blood, probably exercise a considerable influence on the formation of venous clots.

Among others who have carefully described the pathological appearances presented by the veins is Velpeau. He says,—“The clots contained in the veins are black, yellow, white, or greenish, and have a granular texture, which may be shown by cutting or squeezing them with the finger; they sometimes contain globules of pus discernible with the naked eye. True purulent centres are not seldom met with in the thickness of the rather numerous clots contained in the heart, or in the larger vessels.” The changes in the veins, according to Arnott, are limited by the entrance of a branch vessel where the trunk is concerned, and when a branch is concerned, by its junction with the trunk. Tessier supposes that, with suppurative phlebitis, there is always present adhesive phlebitis, which makes it impossible for the pus in a vein to overcome the barrier which separates it from the circulating current. Among patients who have succumbed to purulent fever, he says

that the veins will be found to be filled either with coagulated blood or pus, or a yellowish, semifluid, pulpy substance, and that these matters are met with alternately at greater or less distances in the same vein. Baker observes that "the lining membrane of veins is rarely inflamed; that, when inflammation does attack it, the pathological changes are discovered in the coats, and not in the contents of the vessel; and that the evidences of its presence are to be found in a cloudy opacity of the epithelial layer, and a fine elementary growth in the connective tissue.*

Morbid Condition of the Blood.—The chemical changes which the blood undergoes in suppurative fever have been frequently investigated; but the only result as yet obtained by such analyses has been that of a slight increase of the amount of fibrine in this fluid. The opportunities now offered for such investigations are scanty compared with those which existed when venesection was more common. Moreover, such investigations, in the case of other diseases, have not as yet yielded results sufficiently important to entice observers to prosecute similar researches with regard to suppurative fever.

The alterations presented by the blood corpuscles in pyæmia, as seen under the microscope, have been already fully described. They affect, apparently, only the red corpuscles, which become crenate and misshapen—as if undergoing disintegration—and aggregate loosely in amorphous heaps instead of forming roulettes. Among these irregular clusters of red corpuscles are seen floating numerous granular bodies resembling chiefly pus corpuscles. When the blood is examined after death, its red

* Baker. 1866, pp. 5, 6.

corpuseles are found ill formed and disintegrating ; while commingled with them are numerous pus globules.

The physical aspects of the blood have been described by various writers on pyæmia. This fluid after death is found to be more liquid than natural, while during life it is unnaturally coagulable. Arnott, however, remarks on the other hand, that a "fluid state of the blood, which has been noticed after death from phlebitis, is neither invariably present, nor does it prevail throughout the whole circulating system."

The blood, after death from pyæmia, in most instances retains its natural colour ; but it sometimes has the colour of water in which meat has been macerated, and at other times it is mixed with puriform fluid or with true pus. The serum is commonly of an unnatural, greenish-yellow colour, and turbid. In the cavities of the heart there are generally found coagula, healthy in appearance, and of firm consistence. These clots do not occupy one side of the heart in preference to the other. They consist of fibrine, which, however, is generally less contractile than natural ; and of blood corpuscles. Sometimes they appear more or less decolorised. Clots, as we have before remarked, are also found in the blood-vessels after death, especially in the veins. These clots are also generally more or less decolorised, and often adherent to the walls of the vessel. When recently formed such coagula are friable. By-and-by they become of firm consistence, lose their natural colour, and soften in their centres. This liquefaction in the centres of the clots is at first owing merely to the disintegration of a portion of their fibrinous and corpuscular elements ; a reddish or yellowish puriform pulp or fluid is next observed ; and

lastly, true pus, or a greenish-yellow puriform fluid, occupies the centre of the clot. This liquefied centre of the coagulum is separated most commonly from the venous walls, and enclosed by a layer of consistent fibrine acting as a septum or cystic capsule. According to Bristowe, it is the exception in pyæmia to meet with clots having softened centres. "Similar coagula to those we have just described have been detected," he says, "in the small vessels leading to the diseased patches occurring in other organs besides the lungs—in the vessels, for example, of the heart, the spleen, the kidneys." "It is only in the worst and most rapidly fatal cases," observes Savory, "where there has not been time for the local lesions to appear, that any change in the blood can be detected. This blood very soon becomes putrid. Indeed, in extreme cases it may be said to be putrid at the time of death; for, however soon after the body is examined, there is evidence from its odour and the changes which the blood and the soft tissues present, of rapidly advancing decomposition. They may truly be described as rotten." These changes in the blood, as we shall hereafter see, constitute, in fact, the starting-point from which all the morbid lesions found in the viscera after death from this disease originate.

Hence the increased coagulability of the blood, the disintegration of the red corpuscles, and the presence in this fluid of pus globules, may be considered to be the primary effects of that constitutional alteration excited by some unknown and pervasive morbid agent (or by whatever other term it may be designated) whose onset is indicated by rigors.

Resumé of the Pathology of Suppurative Fever.—Having examined the pathology of suppurative fever

in detail, we find that the morbid processes which take place in this disease, and which are characteristic of it, commence with an increased coagulability of the blood during life. This may be due to various causes, of which the special one in this instance is unknown. The amount of fibrine in this fluid is increased, its red corpuscles become crenate at their edges, collect in irregular masses, and show a tendency during life to undergo disintegration. Further, among these collections of red corpuscles are observed numerous granular bodies, bearing all the characters of pus globules.

In the viscera, the most pathognomonic lesions found after death are purulent deposits, circumscribed and more or less isolated when present in parenchymatous organs, as the lung and liver—diffuse when they occur in the loose cellular or fibrous tissues. These secondary abscesses commence with congestion of the capillaries in a limited portion of tissue, as a lobule. The already coagulable nature of the blood tends to stagnation in such overloaded vessels; and probably embolia or minute capillary coagula are developed. The exudation of serum (which is generally the immediate result of such an arrestment or retardation in the circulation) is the next stage, and passes quickly into that of an effusion of lymph or of the formation of pus. Thus are the visceral abscesses developed; and such a mode of formation accounts equally for those met with in organs whose vascular supply is more diffuse, such as the joints, and for those present in organs whose ultimate elements are each surrounded by a vascular network, as is the case with the lungs. This explanation of the origin and formation of visceral abscesses appears to me to be much more consistent with the

observations detailed in the preceding pages than those hypotheses which account for their development from embolia caused by the plugging of the capillaries of an organ with minute portions of disintegrated fibrinous venous clots, or with fragments of fungiform excrescences from the cardiac valves. That these secondary visceral abscesses should be observed most frequently in the lungs, in the liver, in the kidneys, and in the other vascular organs, is readily explained by the theory we have just described. The viscera through whose capillaries the largest amount of abnormally coagulable blood circulates, and in which the processes of oxidation and of the elimination of various substances from the blood chiefly take place, may be readily admitted to be those which are most liable to undergo the processes above described.

These morbid lesions may affect any portion of the nervous system. They commence with congestion; extravasations are frequently met with on the surface of the brain; lymph is deposited on the surface of the dura mater or in the subarachnoid space; and pus may be diffused between its various membranes, or may be collected in the form of circumscribed abscesses. Of the organs of special sense, the eye is the most frequent seat of secondary abscess formation. In the case of the ear, the disease progresses very insidiously from the mastoid cells to the cerebellum and lateral sinus.

As is illustrated by the third table of the Statistical Appendix, the chief seat of the secondary inflammations, characteristic of suppurative fever, is the thorax. The pleuræ are generally inflamed, and adherent through the deposit of recent lymph, or agglutinated by means of old adhesions; while the amount of serum in their

cavities is increased, and this fluid is mixed with pus. The lungs are consolidated in their lower half, and they are often emphysematous or œdematous in the remainder of their extent. Secondary abscesses are studded over their surface, or discovered, on section, deeply imbedded in their substance. Accordingly, in the midst of engorged pulmonary tissue are seen red spots, with whitish or bluish-white or yellowish centres, having each a limiting zone of bright-red congested vessels. They vary in size from that of a hemp seed to that of a hen's egg. When of large size, these abscesses often present a distinct lining membrane; and they contain pus corpuscles, fatty granules, disintegrated blood globules, and amorphous débris composed of broken down pulmonary tissue. Confined at first to one lobule, these secondary pulmonary abscesses soon implicate the neighbouring lobules, and thus extend themselves.

A similar process takes place in the liver; but the abscesses met with in this organ are generally of a larger size than those we have just described. It may be affirmed that the secondary abscesses observed in the hepatic viscus after death from suppurative fever have the same origin, exhibit the same alterations, and present the same appearances as those found in the lungs. But occasionally abscesses are met with in the liver, when none are found in the lungs or elsewhere.

In accordance with the view expressed above, we find secondary abscesses most frequently in the cortical substance of the kidney—that portion of the renal organ which contains the Malpighian bodies, and which is most vascular. These secondary purulent deposits pursue the same course in the kidneys as in the other viscera already alluded to.

Secondary abscesses are observed frequently in the spleen; but owing to the pulpy character of its substance, the changes they undergo are so rapid as often to render their recognition after death a matter of no slight difficulty.

These purulent deposits have been met with also in the œsophagus, stomach, and intestines; and in these viscera they show a great tendency to ulcerate.

Among the pelvic organs the prostate is the most common seat of secondary abscesses; and next in frequency are the testes.

The most characteristic pathological alteration of the skin met with in this disease is its dusky icteric tinge; but there are also sometimes observed sudamina, pustules, bullæ, purpuric-like patches, and true cutaneous abscesses resembling carbuncles; while the edges of the wound, in some instances, exhibit an erythema-like blush.

True secondary abscesses occur, also, in the subcutaneous cellular tissue and in muscles. These are distinguished, however, by their not presenting any well-defined zone of congestion, and by their not being confined by a wall of plastic lymph. They spread over the surface of these organs, as well as permeate their substance.

The inflammatory changes which are observed in the lungs and liver as the result of the systemic affection termed suppurative fever, are markedly developed also in the bones and joints. The periosteum of the former is thickened and infiltrated with pus, as is also the capsule of the latter. In both, as in the parenchymatous viscera, the congestive stage is first observed, and is followed by the effusion of serum, by the deposition

of lymph, and by the formation of pus. The medullæ and cancellated tissue of bones are the parts chiefly affected by the suppurative process ; and these changes are observed in the flat as well as in the long bones. The soft, synovial tissues of the joints first yield to the macerating and degenerative action of their purulent contents. By-and-by the ligaments give way, the cartilage of incrustation ulcerates, and the subjacent bone becomes carious. The lymphatic glands are occasionally the seats of secondary purulent deposits, and inflammation and suppuration of the lymphatic vessels have been described.

Lastly, the veins are frequently observed after death from suppurative fever to exhibit all the appearances characteristic of phlebitis. In some instances they are healthy, excepting their lining membrane, which is abnormally vascular and of a pink colour. In other cases their walls are thickened and infiltrated with lymph or pus, and their interior is occupied by a more or less firm clot, which is occasionally adherent to the walls of the vessel, or surrounded by a delicate membrane. The wall of a vein has been observed, moreover, to ulcerate at one point, while here and there along its tract the clots are found to be pultaceous in their centres, or to have been transformed into pus. These clots are generally connected with those portions of the veins supplied with valves, and with those parts at which branches join the main trunks.

CHAPTER VIII.

ETIOLOGY OF SUPPURATIVE FEVER.

IN order to attain a complete knowledge of any disease with the view of combating it successfully, it is necessary that its origin, as well as the symptoms it presents during life and the pathological traces found after death, should be carefully studied. In the case of most diseases, the recent advances in medical science have thrown much light on the conditions which predispose to their accession, even though the ultimate causes in which they originate cannot be defined. As yet, notwithstanding the very great amount of attention which has been devoted to the investigation of the origin of suppurative fever, the goal is comparatively distant. The careful observation of the disease in patients, and its attempted production in animals by experiment, have both been employed with the greatest assiduity, but without yielding any very definite result.

The causes of suppurative fever may be looked upon as *Predisposing* and *Exciting*. The predisposing causes of suppurative fever seem to bear a very trifling relation to the serious nature of the disease; and they consist, mainly, of those altered conditions of the system which tend to induce many other morbid states of the body, especially those of the febrile type.

(A.) PREDISPOSING CAUSES OF SUPPURATIVE FEVER.

Sex and Age.—The majority of instances of suppurative fever are met with among males, and those of adult age. This is readily explained by the circumstance that youths and men are chiefly exposed to wounds and injuries, and are also more liable to be attacked by those osseous affections, in connection with which pyæmia most commonly supervenes. As a sequent of acute necrosis, suppurative fever has been met with by Savory * in a child ten months old ; and Bristowe mentions its occurrence in a child nine months old.† In a paper of still later date, Savory states that he has known pyæmia to attack a child four days old.‡ It is well known that the rate of mortality after amputation in youth is much smaller than among those of maturer years ; and the experience of every day goes further to prove that in youth recovery under the most adverse circumstances is the rule rather than the exception ; and that, in fact, children recover from almost any ailment, whether a severe injury or a serious illness. Women are less exposed to accidents and operations than men ; but we find suppurative fever occurring in them after parturition. If we accept suppurative and puerperal fevers as identical, or at all events analogous, we have some grounds for comparing the mortality in the sexes, caused by these two forms of disease. In the accompanying tables the particulars just mentioned are confirmed by numbers.

* Savory. "St Bartholomew's Hospital Reports," 1865, vol. p. 275.

† Bristowe, p. 212.

‡ Savory. "St Bartholomew's Hospital Reports," 1867, vol. iii. pp. 19-72.

TABLE ILLUSTRATIVE OF THE AGES OF PYÆMIC PATIENTS.

AGE.	Authors.						Cases collected from various sources.
	Lee.	Velpeau.	Cases recorded in Chap. II. of this vol.	Savory.	Wilks.	Cases reported in the "Medical Times and Gazette," vol. i. 1865.	
At 4 days, . . .	...	...	...	1			
„ 1 week, . . .	...	...	...	1			
„ 14 days, . . .	...	...	...	1			
„ 5 months, . . .	...	...	...	...	...	...	2 (Wilson.)
„ 1 year, . . .	...	...	...	1	...	..	1
„ 17 months, . . .	...	...	...	1	...	..	1
„ 3 years, . . .	...	...	...	...	1	...	1
„ 3 $\frac{3}{4}$ „ . . .	...	...	...	...	1	...	1
From 5 to 10 years, . . .	...	...	...	5	5	...	2
„ 10 „ 15 „ . . .	1	...	3	15	9	1	2
„ 15 „ 20 „ . . .	3	3	2	23	9	1	6
„ 20 „ 25 „ . . .	3	1	...	15	16	5	1
„ 25 „ 30 „ . . .	3	3	2	11	7	7	
„ 30 „ 35 „ . . .	3	...	2	12	10	1	1
„ 35 „ 40 „ . . .	4	2	2	7	10	1	
„ 40 „ 45 „ . . .	5	1	3	9	12	1	
„ 45 „ 50 „ . . .	3	1	3	9	13	5	1
„ 50 „ 55 „ . . .	...	1	1	8	7	4	
„ 55 „ 60 „ . . .	3	...	1	2	5	1	
„ 60 „ 65 „ . . .	...	...	...	5	4	2	
„ 65 „ 70 „ . . .	...	...	...	...	4		

TABLE SHOWING THE COMPARATIVE MORTALITY OF THE SEXES AFTER PYÆMIA.

Authors.	Males.	Females.	Total.
Lee, ...	22	8	30
Velpeau, ...	10	2	12
Savory, ...	96	28	124
Wilks, ...	94	19	113*
Cases recorded in Chap. II. of this vol., ...	19	1	20
Cases reported in "Medical Times and Gazette," vol. i. 1865, ...	23	8	31
Cases collected from various sources, ...	13	6	19

* These 113 cases were carefully selected from Dr Wilks' report of 173 cases, because they presented distinctly either the symptoms or the pathological lesions characteristic of suppurative fever. This method of selection has been applied also to the various other sources which furnish the contents of these two tables.

Seasons of the Year.—It is worthy of notice, in the case of fevers and many other diseases (and the same holds true also of suppurative fever), that they prevail most during those months of the year in which the weather is most changeable. We observe, accordingly, that, as regards the season of the year, suppurative fever is rife during the months of spring and autumn, when sudden atmospheric changes occur which cannot in this country be guarded against. The experience, moreover, of most hospital surgeons has no doubt shown them that during these months railway and other accidents are very frequent.

Baron Larrey observed that during the campaign in Egypt, in 1800, this fever raged during the months of April and May.*

Occupation and Mode of Living.—There is no evidence to prove that the pursuit of any particular trade or profession induces a liability to suppurative or puerperal fever. It is rarely, indeed, that those who spend their lives in avocations considered unhealthy become exposed to injuries and operations, or to the other exciting causes of this disease. The muscular railway labourer and the stalwart quarryman are the usual victims of pyæmia. Some have supposed that it is the character of their calling, together with their general mode of life, which, by debilitating their constitutions, conduce to the accession of suppurative fever in this class of persons. Little stress, however, is to be laid on predisposing causes of this kind, inasmuch as intemperate habits, badly ventilated houses, destitution, food inadequate in quantity or in quality, are capable of inducing any of the numer-

* Larrey. 1812, p. 19.

ous ailments which attack the human frame. Among comparatively few of the many patients who die of pyæmia are such conditions present. Those operated on for diseases of long standing are seldom attacked by suppurative fever. They, as a rule, recover after operations, while the strong and healthy workman often succumbs.

Bodily fatigue, shock, and hæmorrhage, by impairing the general health and depressing the nervous powers, may be looked upon as predisposing causes of suppurative fever; but their influence is not confined to this affection alone.

“The disease,” says Sir J. Y. Simpson, “is confessedly more common and more severe among the population of towns than among the population of the country; and it is more frequent and more fatal among hospital patients than in private practice; and much more so in crowded wards than in those where the patients are few, and provided with a full and free supply of fresh air.” This statement, the bearing of which will be discussed in detail under the title of contagion, has by recent experience been proved to have less foundation than was supposed.

In four, among the twenty patients whose cases I have narrated, were these predisposing causes present; while the remainder (with three exceptions) enjoyed the most perfect health, till the occurrence of the accident, operation, or local inflammation which was followed by suppurative fever. The patients IV. and IX. were men of intemperate habits; the woman in Case XIV. had been subject to the debilitating influence of scanty food and bad accommodation prior to her admission into hospital; and in the case of the patient

XIX. hæmorrhage had reduced his strength so much that a very trifling operation was followed by pyæmia.

TABLE SHOWING THE RELATIVE MORTALITY FROM SUPPURATIVE FEVER WHICH OCCURRED AFTER VARIOUS OPERATIONS IN PROF. SPENCE'S WARDS IN THE ROYAL INFIRMARY OF EDINBURGH, DURING THE YEARS 1859-65.

Date.	Total No. of Cases.	Nature of the Operation.	No. of Deaths from Pyæmia.	The Part operated on.
1859-60	4	Primary amputations, .	2	{ Both were amputations of the leg.
	14	Secondary amputations, .	1	An amputation of the thumb.
	4	Excision of diseased joints, .	1	Excision of the knee-joint.
	2	Perineal section, . . .	1	For stricture of the urethra.
1860-61	11	Primary amputations, .	1	An amputation of the thigh.
	14	Secondary amputations, .	1	An amputation of the arm.
	11	Excision of diseased joints, .	1	Excision of the elbow joint.
1861-62	12	Primary amputations, .	3	{ All of them were amputations of the leg.
	30	Secondary amputations, .	3	{ All of them were amputations of the thigh.
1862-63	20	Secondary amputations, .	5	{ Of these, four were amputations of the thigh, and one of the forearm.
	2	{ Primary excisions of joints for injuries, . }	1	Excision of the knee-joint.
	5	Excisions of the mamma, .	1	
	9	{ Cases of removal of malignant tumours of the face and neck, . }	1	
1863-64	10	Primary amputations, .	2	{ Of these, one was an amputation of the arm, and the other of the leg.
	18	Secondary amputations, .	4	{ Of these, one was an amputation of the forearm, two were amputations of the thigh, and one of the ankle.
	8	{ Excisions of joints for disease, . . . }	2	{ Both were excisions of the elbow-joint.
	17	Removal of tumours, .	1	{ Removal of a fibrocartilaginous tumour in the long head of the crural biceps.
	5	Wounds into joints, .	1	{ A case of wound into the knee-joint.
	3	Lithotomy, ...	1	
1864-65	7	Primary amputations, .	1	An amputation of the leg.
	17	Secondary amputations, .	8	{ One of these was an amputation at the shoulder-joint, two were amputations of the forearm, two of the thigh, one of the leg, and two of the ankle.
	4	{ Excisions of joints for disease, ... }	1	Excision of the elbow-joint.

Individual Idiosyncrasy.—Such a cause as hereditary predisposition to pyæmia has not been proved. Suppu-

rative fever is connected too intimately with local changes to be considered as a hereditary constitutional affection or cachexia, like scrofula ; or to be associated with any one special diathesis, as the neuro-arthritic. Many observers have endeavoured to explain the greater frequency of secondary abscesses in the lungs, in the liver, or in the kidneys, by tracing in the history of the patient some latent form of pulmonary, hepatic, or renal affection. As a rule, no such coincidence is demonstrable ; and, as before stated, the majority of the victims to suppurative and puerperal fevers are the healthiest of our race. The presence of organic visceral diseases, and the debility often attendant on convalescence after acute disease, have been considered by some as sources of pyæmia ; but they predispose only by impairing the constitution. The fact must not be overlooked, that many more of those who undergo amputation for injuries produced by an accident are attacked by suppurative fever, than of those who have amputation performed on account of disease.

According to Sir J. Y. Simpson, "there are epidemic states in which puerperal and surgical fever is frightfully common. Some localities and towns are far more frequently the seat of it than others, and various states of the economy seem to predispose to it or against it. Surgical and obstetric patients suffering under internal and organic diseases (particularly of the abdominal viscera), and under certain functional derangements of the kidney, and perhaps of other organs, seem specially to be attacked with this consecutive fever or inflammation."

Statistics are often very fallacious, though they are

useful, if not regarded as the only guides of practice. Among the twenty cases I have selected as typical examples of the phases presented by suppurative fever, in only two (Cases III. and V.) was there any evidence of pre-existing organic disease.

“The partial symptoms,” says Travers, “vary in individuals according to their temperament and habits; so that, in a person of phthisical diathesis, the weight of the injury would fall upon the lungs; whereas, in one subject to hepatic congestion, it would probably fall upon the organs included in the system of the vena portæ; but the variety of the casualties and the diffusedness of the mischief, plainly show that in the case of recent injury it is by the medium of the universal sympathy that the site and extent of the morbid action is determined.”

It is generally stated in surgical works, that pyæmia follows primary amputations much more frequently than amputations for disease. In opposition to this, the argument might be used, that those who suffer from organic diseases are not able to work as railway labourers and quarrymen, and therefore are not so liable to meet with the accidents which most frequently necessitate primary amputation. But the rarity of pyæmia after amputations for disease greatly outweighs such reasoning. Though in the latter instance the morbid changes have been of longer duration, and have engrafted themselves on the constitution of the patient; yet shock, exposure to cold, fatigue, and extensive injury suddenly inflicted on previously healthy living textures, cause a depression of vital action not readily overcome. In cases of amputation for disease, relief is afforded by removing the cause which

maintains the constitutional disturbance ; but amputations for injury are usually performed before the vital equilibrium which has been overturned by the injury is restored, and, after the operation, a tedious convalescence must be encountered, ere the constitutional effects of the accident have passed off.

(B.) EXCITING CAUSES OF SUPPURATIVE FEVER.

Its Spontaneous and Contagious Origin.—The important as well as most difficult problem—the origin and spread of suppurative fever—may be now discussed. It is needful always to employ the greatest care in tracing the origin of fevers to miasmatic influences, or to overcrowding; and in accounting for their communication to others by such media as fomites. We accordingly find very opposite opinions held by surgeons respecting the spontaneous origin and contagious character of pyæmia. All, however, agree in considering that the crowding together in small wards of operation cases, or of puerperal women, must provide a very fertile soil for the springing up of the germs of these fevers ; just as such conditions are found to favour the production and increase of cholera and febrile diseases in general.

Before discussing in detail the arguments in favour of and against the doctrine of the contagiousness of suppurative fever, let us endeavour to find out the origin of the disease. The largest number of the cases of pyæmia which have been published are derived from hospital practice ; but I am convinced that very many cases occur also in private practice, and that such, if made public, would probably be the most interesting and instructive. It is an easy matter to ascribe the large

proportion of patients who fall victims to this fever in our hospitals, to bad ventilation, resulting from the overcrowding of wards with an undue accumulation of traumatic and puerperal cases ; and to noxious effluvia originated by the copious unhealthy discharges of so many extensive wounds. Some hospitals, especially in large towns, are, perhaps, never free from the noxious principle which excites pyæmia ; but even in these, it is observable that while in the course of one year the wards of one surgeon suffer severely from the depredations of suppurative fever, during the following year it is the patients of another surgeon who are the victims of this fearful plague. Pyæmia is not stationary, but exhibits a most remarkable eccentricity in its invasions. My experience of hospital practice induces me to think, that bad ventilation and the crowding together of patients are not the only exciting causes of this affection.* For example,—I had charge of two wards (among others) which were especially devoted to cases of accident and operation, and which may be designated respectively A. and B. A., the accident ward, was twice as large as B., and contained, as a rule, very few operation cases. It was ventilated, moreover, in three separate ways,—by ventilators which carried in the air of the corridors ; by the door and a row of windows opposite to it ; and by two series of windows opposite to one another above the preceding, of which one set had perforated zinc panes. This ward was, accordingly, always fresh and well ventilated. Ward B., however, was the favourite ward of the surgeon ; and contained likewise ten beds, almost all of which were generally filled with operation cases. Of the twenty I have before enumerated, Cases III., IV., V., IX., XI., and XIX. were suc-

cessively in ward A. ; and cases VI., VII., and XVIII., were together in ward B. When the former six patients were in ward A., the majority of the other cases were simple fractures ; and each of these was the only operation case at the time in the ward. Along with the three latter patients in ward B. were the following cases : one of gangrena senilis, one of excision of the wrist, another of excision of the shoulder (Case XVII.), one of compound fracture of the leg, one of ligature of the right common carotid artery for aneurism, one of lithotomy, and an ulcer case. As soon as possible after the death of these three pyæmic patients, ward B. was emptied, fumigated, and ventilated thoroughly for a month, before patients were readmitted ; and no further cases of suppurative fever occurred in it. Ward A., on the other hand, had been undergoing repair during several months prior to the date I am reckoning from, and had been empty for about a year ; and yet almost every operation case which was put into it died of pyæmia. This seems to me to show that though hygienic measures serve to prevent the spread of pyæmia when it has broken out, and also ward it off by not furnishing the genial soil of filth and noxious odours for the fructification of the germs of this disease, still, patients placed in the most favourable circumstances as regards hygiene are not exempt from its attack.

Can pyæmia, when it occurs in hospitals, be traced to inoculation by the hands of attendants ? It is of great advantage for students to attend to the dressing of wounds in surgical wards ; but is the patient's life hazarded thereby ? It is possible to conceive that, when students rush out of the dissecting-room into the hospital, and proceed, after a very hurried manual ablu-

tion, to dress wounds, they may occasionally be the unwitting and unfortunate means of inoculating their patients with deleterious matter which may excite suppurative fever. There is no evidence, however, to prove such a supposition. A greater risk is run by patients in having their wounds cleansed and attended to by nurses, who, in many instances, take little interest in the welfare of their patients, and do their routine work as hurriedly as possible. All house-surgeons should insist on their dressers washing their hands in some disinfectant fluid, so as to avoid the possibility of inoculating the patients with any *materies morbi*.

Is pyæmia or suppurative fever contagious? That is, Is it communicable by media? Such means of propagation are manifold, yet there is no proof that they spread the disease. On the contrary, many facts like the following might be adduced. Along with the wards A. and B., mentioned before, I had charge of a third ward C., which contained ten female patients, was of the same size as B., and on the same floor as A. and B., with one common corridor for all the three wards. The nurses of these wards were in the habit of conversing together, and of passing close to one another, and they were numberless times daily within such a proximity as to impart to each other the contagious principle of pyæmia, if such existed. During several hours daily students and others visited these wards; and among the ten inmates of ward C. there were, as a rule, six or eight patients who had been operated on, and yet not a single case of suppurative fever occurred in ward C. while I had charge of it.

“Patients during labour,” remarks Sir J. Y. Simpson,

“have been and may be locally inoculated with a materies morbi capable of exciting puerperal fever, and which is transferable by the fingers of the attendant acting like the ivory points of the older vaccinators;” and to prove this statement, he quotes the interesting fact, that while, prior to 1846, the mortality of puerperal cases in the Vienna Hospital was one in ten, subsequently to 1848 it fell to one in seventy-four. This was traceable to Dr Semelweiss, in 1847, requiring students to abstain from touching parts at the autopsies, and obliging them to wash their hands in a solution of chlorine before and after every vaginal examination, and it goes far to corroborate the supposition that puerperal fever is inoculable and thus contagious.

But Sir J. Y. Simpson further remarks, that “surgeons, like accoucheurs, are occasionally the unhappy media of inoculating their patients with morbid matter, producing in them surgical fever. We do not believe,” he continues, “that the disease is propagated directly from individual to individual, but indirectly through the medium of a third person.” To confirm this hypothesis there is no proof. On the contrary, the evidence procurable on this point tends rather to disprove the statement. Daily are hundreds of patients, in our hospitals, exposed to inoculation by means of a third person,—viz., by surgeons, by students, and by nurses,—and yet how comparatively few instances of pyæmia are met with! The epidemics of suppurative fever which occasionally break out in hospitals, cannot be ascribed to contagion. One constantly observes this fever attacking the patients of one ward while those next door escape. Further, it is often remarked, that in a ward, in which there are many fit

subjects for the disease, one patient suffers at a time' and after his death another is attacked, and so on consecutively.

As far, then, as our knowledge at present warrants, we can only conclude that suppurative fever is not contagious. It is desirable, nevertheless, to isolate cases of suppurative fever, and to remove them from amongst operation cases, lest the latter should be exposed to any deleterious influence.

Phlebitis, the exciting Cause of Suppurative Fever.
—The very frequent existence of inflammation of the veins, in cases of death from suppurative fever, led the older observers to conclude that this pathological condition was the exciting cause of this disease. Those who held this view have naturally devoted most attention to this pathological lesion, and appear, in some instances, to have misinterpreted their observations so as to make them suit this theory. It is comparatively seldom, however, that the symptoms of this affection are manifested during life ; and after death, as we have before stated, the phenomena characteristic of phlebitis are frequently not observable. The circumstance most commonly noted is the existence of coagula in the veins leading from a wound, or from a stump, or from the uterus, in those who have died of this fever. Such coagula are generally healthy in appearance and of firm consistence ; but when of old formation they become softened in their centres, and sometimes even undergo suppurative changes. We have before remarked that the blood, in suppurative fever, is extremely coagulable during life ; and this circumstance, along with an irritable condition of the veins accompanying the inflammatory state of the constitution generally, accounts

readily for the not uncommon occurrence of coagula in the veins of patients who have died from suppurative and puerperal fevers. Too much stress has been laid on the presence of venous coagula. They should be regarded in the same light as the other pathological lesions met with after death from this disease. They are, in fact, the consequence, not the cause of this affection.

Such a statement, then, as that of Arnott, that "the inflammations and abscesses which arise in remote situations after injuries, whether of the extremities or of the head, or after the process of parturition, are attributable to the existence of phlebitis in the part of the body primarily affected,"—is to be viewed by the light of modern researches as a misplacement of cause and effect.

H. Lee endeavoured, by experiment, to disprove the then generally supported doctrine of the phlebitic origin of suppurative fever. His argument was, that pus introduced into a vein coagulated the blood in this vessel, and that this fluid, being thus circumscribed, could not possibly circulate through the body. In order that pus may circulate, the coagulation of the blood must either be impaired, or the barrier which separates the purulent fluid from the general circulatory stream must be broken down by mechanical means. The basis of this argument has been repeatedly proved, by most careful experiments as well as by observation of cases, to be incorrect, and thus the whole theory falls to the ground. Pus injected into a vein does not produce coagulation of the blood at the point of injection. It has been seen, in Professor Hughes Bennett's experiments, to commingle and to circulate side by side with the blood in the veins. How often, moreover, does one meet with instances of

the absorption of abscesses ? and, in such cases, the purulent materials (*alias* the pus) must first enter the general circulation ere they be eliminated.

I injected one and a half drachms of pus, taken from a scrofulous abscess of the hip, into the right jugular vein of a small King Charles dog, and was surprised to find that the only symptoms were want of appetite and depressed spirits on the day following the operation. On the third day after this, the animal was perfectly well and the wound healed. I concluded that the injection of pus into a vein causes almost no constitutional disturbance. This purulent origin of suppurative fever will, however, be again considered in another portion of this chapter.

Analysis of Experiments.—Before examining the remaining morbid conditions to which has been ascribed the origin of pyæmia, it will be of advantage to review shortly some of the series of experiments which have been made by various observers, as well as the conclusions arrived at by them.

Castelnau and Ducrest injected various substances into the veins and tissues of animals—such as milk, urine, semen, putrefying substances, metallic mercury, corrosive sublimate, &c., with these results :—

1. That visceral abscesses resulting from the injection of other fluids than pus were situated almost always solely in the lungs ; while those resulting from pus may occupy various other parts of the body, and may even be met with in them while the lungs continue exempt.

2. There is no single symptom induced by purulent intoxication, which may not be caused by the injection of some of these substances ; but this

is not the case as regards the combination of the symptoms.

3. Each category of foreign bodies has its own mode of action. These observers injected pus into the saphena vein of seven dogs, and of this number five died. In the latter were found either "multiple" abscesses completely formed, or lesions indicative of the incipient stage of such abscesses.* They concluded from their researches :—

I. "That 'multiple' abscesses are due to a changed condition of the blood, which is most frequently, and perhaps always, produced by the presence of a foreign principle in this fluid."

II. That "in those abscesses which are developed in the puerperal state, after traumatic lesions, surgical operations, or phlebitis, this principle is pus."

III. That, "when abscesses are developed in certain other diseases, the principle is that which gives rise to the disease itself."

IV. That "the progress, prognosis, and treatment of these abscesses, entirely depend upon the nature of the cause that has produced them."

Sédillot made forty-five experiments on dogs. After the single injection of 61·736 grains (Troy) of pus, the animals recovered. After the injection of 231·510 to 308·680 grains of pus the animals also recovered ; but the symptoms were more severe. After the injection even of foetid pus they recovered, but a much smaller quantity of this fluid was fatal ; and this result he ascribed to the foetidity of the fluid. Sédillot found, also, that the injection of diluted chyme produced very

* Castelnau and Ducrest. 1846, tom. xii. p. 78.

analogous symptoms ; and when in equal quantities perhaps even more serious ones. In two instances putrid water was injected, and both ended fatally.

In three instances pus globules diluted with water were injected, and death resulted in all three.

In seven instances the serum of pus was injected. In three of these putrid serum was injected, and death occurred with gangrenous lesions of the lungs. Three of the four remaining ones terminated fatally, and of these latter one showed distinct metastatic abscesses ; another exhibited circumscribed indurations of the lung, each containing " a cavity filled with a reddish mucous fluid ;" and the third, on the fifth day after injection, presented in both lungs " ecchymotic patches with black centres."

Blood and its serum were injected separately, and produced severe symptoms, but were only once fatal.

Further, when the fluid was injected into the mesenteric veins it gave rise to exactly the same appreciable changes as when it was injected into the jugular vein—" the liver seeming to offer no obstacle to its passage to and arrival at the lungs." Sédillot considers that there are " two distinct diseases, though connected by some appearances in common—the one is determined by the solid elements of the pus, the other by the putridity of some animalised substance." He holds also that the products of the putrefactive fermentation of pus do not induce pyæmia, but gangrenous affections (septicopyæmic). The results arrived at by Sédillot are :—

I. That after single injections of pus, animals, if

previously healthy, usually recover ; but that this is not invariably the result.

II. That the simple inoculation with pus of the tissues surrounding a vein is followed by slight local suppuration, the blood remaining unaffected in the adjacent vessels ; that no change results from the application of pus to the edges of wounds in venous trunks, although in these experiments some pus globules probably pass into the circulation ; and that the wounded veins are repaired in the usual manner.

III. That injections of small quantities of pus are usually followed by secondary deposits.

IV. That if the animal is healthy the secondary appearances pass off.

V. That the secondary abscesses are obtained by injections *repeated at intervals in animals constantly enfeebled by disease*.

VI. That similar or analogous results follow the injection of many other substances besides pus.

Lastly, it happens sometimes that pus, and it is only of pus the fact has been recorded, slips by one set of capillaries.

H. Lee found, on mixing pus with blood *external* to the body, that the latter was coagulated, and concluded that the same result followed the injection of pus into the veins. Hence, he remarks, this fluid (blood) must be altered in its constitution so as to become less coagulable, ere pus can enter the general circulation. "The introduction of pus into the system through an injured or inflamed vein," he says, "can rarely be the first step towards purulent infection of the system. Some change must have previously passed in the blood, by which its coagulating

power is impaired, or some unusual mechanical means must have been employed, before the pus can find its way into the course of the circulation. It would appear, therefore, that there are two principal conditions under which local disease can produce a general infection of the system : the first of these is connected with defective union in injured veins ; the second is associated with want of healthy adhesion in inflamed lymphatics." * Being based on wrong premises, Lee's conclusions are readily overthrown, and his experiments have not shed any light on the mysterious origin of suppurative fever.

Professor Hughes Bennett endeavoured to discover a close similarity between leucocythemia and pyæmia. In his treatise on the former disease he showed that many of the appearances observed in the veins after death from suppurative fever were detectable also in these vessels after death from leucocythemia. In both diseases coagula were found in the veins on post-mortem examination. The blood in both classes of patients exhibited under the microscope granular bodies not distinguishable from one another, and yet termed white blood corpuscles in the case of leucocythemic patients, and pus corpuscles in the case of pyæmic patients. In those suffering from either of these affections the blood is observed during life to be unnaturally coagulable. Hence these two diseases exhibit a very striking analogy when viewed from a pathological point. That secondary abscesses cannot originate from the impaction of pus corpuscles in the minuter blood-vessels, Bennett disproves by the fact

* Lee. 1850, pp. 45 and 48.

that these bodies are identical in size with the white blood corpuscles which are so numerous in the blood of leucocythemic patients, and which cause no retardation of the circulation. He also concluded from his experiments on animals that putrid fluids *prevented the coagulation of blood*. This, as we have observed, is the opposite condition to that which characterises suppurative fever.

J. S. Gamgee experimented on two horses and a pony. His experiments were seven in number, as follow :—

Experiment 1.—He injected two and a half drachms of healthy pus into the jugular vein of a horse, which produced slight constitutional disturbance, and the animal got better in a few days.

Exp. 2.—Into the opposite jugular vein of the same horse two drachms and a scruple of healthy pus were injected two days later ; but this experiment failed.

Exp. 3.—Into the same vein as that used in Experiment 1, two drachms and a scruple of healthy pus were injected six days after the last experiment. The animal was killed four days afterwards ; when some signs of phlebitis were observed in the right jugular vein, and the left jugular was blocked up. There were also abscesses as large as peas in both lungs.

Exp. 4.—In this experiment two drachms and a scruple of good pus were injected into one of the jugular veins of an old horse. The animal died in two minutes after the operation.

Exp. 5.—This experiment was performed on a pony, which was none the worse of having a drachm of pus injected into one of its jugular veins.

Exp. 6.—The same pony had two drachms and a scruple of laudable pus injected, seven days after the

last experiment, into the opposite jugular vein. The animal was little affected by the operation.

Exp. 7.—Three hours after the last experiment the same pony received, into the same wound as that last made, one ounce and two scruples of healthy pus. The animal's respirations became laboured, but no other serious symptoms were developed. It was killed on the following day, and the only pathological lesion discovered was congestion of both lungs. "From these experiments I infer," says Gamgee:—

"I. That when pus is fairly injected into a vein, there is no obstacle to its moving on with the current of the blood.

"II. That the first organic effect of such injection is congestion of the lungs, which may be so intense as to prove instantly fatal, or may be temporarily recovered from.

"III. That the abscesses met with in the lungs of individuals who have fallen victims to pyæmia may be produced by injecting pus into the veins of healthy animals."*

Many of the substances introduced artificially into the circulation by Gaspard produced no effect on the coats of the veins which they traversed, and yet the general symptoms were precisely similar to those originating from genuine phlebitis. He found that greasy fluids, and such as contained sediments, do not readily make their way from the small arteries into the veins. Some clear fluids, on the other hand, such as solutions of tartar emetic, of opium, or of nux vomica, when introduced into an artery, pass readily in the course of the circulation, and

* Gamgee. 1853, p. 1079.

produce their full effect upon the constitution, without causing irritation in the blood-vessels through which they pass. Infusion of tobacco, solution of acetate of lead, putrid fluids, &c., do not offer in themselves any mechanical impediment to the circulation of the blood, and *do not produce the same constitutional symptoms when injected into an artery as when thrown into a vein*; but they all excite violent local irritation in the parts to which the branches of the injected artery are distributed, and the constitutional symptoms are due to the local irritation. Gaspard, moreover, injected into a dog's vein the blood of another dog which had died from the injection of putrid matter, and thus produced blood-poisoning. "It is certain," he says, "that putrid substances injected into the veins affect the general mass of the blood, notwithstanding their successive passage and their filtration through the two systems of the lungs and other organs. It is evident that putrid fluids injected into the jugular vein circulate through the whole body, and are not arrested in the capillaries, like mercury, fat, oil, viscid substances, and powders, or any others too coarse."

The experiments of Magendie, Leuret, and Hammont led these observers to conclude that putrid vegetable and animal matter, when introduced into the cellular tissue or injected into the blood, produce symptoms very similar to those of typhus and yellow fever; and that dogs confined over, and breathing the effluvium proceeding from animal and vegetable matters undergoing decay, experience similar symptoms, and the same alterations of the blood, of the secretions, of the excretions, and of the viscera, as are observed in yellow fever. Leuret produced charbon in horses, by placing

under their skin and injecting into their veins the blood of horses which had died of the disease.*

“Abscesses in the lungs, and in one case purulent pleurisy, were found by Batailhé in dogs into whose veins pus had been injected, provided the animals were not poisoned in a few hours after the injection of the pus.” After making many experiments, he concluded that “putrefied pus, mixed with the blood in very small doses, produces metastatic abscesses, provided the pus be injected in small quantities, so as not to kill the animals at once, and to allow of their living long enough for the formation of the abscesses.”†

My own experiments were the following:—

Experiment I.—Injected under the skin of a healthy, moderate-sized dog, nearly a drachm of yeast, rendered fluid by admixture with glycerine and water.

Twelve hours after the operation, the swelling formed by the injected fluid had disappeared. The opening used for injection having been made in a valvular manner, with a trocar and cannula; the injected fluid was believed to have been absorbed, especially as there was great pain felt at the part operated on. The animal was well in other respects. Twenty-four hours later the dog was observed to have repeated rigors. The blood was at this time examined microscopically. The red globules were heaped in masses, and did not form rouleaux. They were crenated and puckered on their surface; and scattered among them were numerous granular bodies, which, on the addition of dilute acetic acid, presented the usual characters of pus globules.

* *Vide* “Copland’s Dictionary,” p. 193.

† Batailhé, in Brit. Med. Jour. Oct. 3, 1863, p. 377.

The blood was abnormally prone to coagulate. The wound was painful, and slightly swollen.

On the third day after the operation the dog's blood was again examined under the microscope, and was observed to be normal, except that some of the red corpuscles were crenated. The seat of injection was greatly swollen, and extremely painful. The animal's health was good. Two days later the animal was still observed to shiver frequently. Its appetite was good, but it hung its head, and was low spirited. Locally, a very large and painful abscess had formed.

Next day the abscess burst, leaving behind it a large raw wound. The animal seemed to be much relieved by the evacuation of the abscess. On the following day (seventh day after the operation) the dog was fairly convalescent, and recovered perfectly without any treatment being used.

Experiment II.—To ensure, if possible, the absorption of the yeast, the following course was pursued. Having cut down on the right femoral vessels of a full-grown terrier, I dissected out the vein as it lay in Scarpa's triangle, ligatured its distal extremity, and divided it. I then stitched up the wound (which was an inch long), and injected into it the same amount of the mixture as that used in the last experiment. The dog ate heartily immediately after the operation, and did not appear to be much inconvenienced by what had been done.

On the following day the wound was swollen, but not very painful. The adjoining skin of the groin and abdominal wall was discoloured and of a purplish-green hue. The animal's appetite was impaired, but it appeared to be well in other respects.

On the second day after the operation the gangrenous

colour of the skin was observed to be extending over the abdomen. The wound gaped. Next day the animal was not so well. The wound was sloughing, and so were also the deep tissues of the groin. The discharge was extremely foetid. The dog did not eat much, and was not at all inclined to move about.

On the fourth day after the operation the animal seemed to be better, and ate more food ; but it was very thirsty, and disinclined to move. There was a gaping wound in the groin, fully three inches long, and very deep. It was separated by a bridge of skin from the wound in the thigh, which extended as far as the knee, gaped, and showed the muscles at the bottom of it in a sloughy state. The odour from these wounds was extremely foetid.

Three days later (seventh day after the operation), the dog began to show signs of convalescence. The slough separated on this day, and the wound began to look healthy. The animal's appetite returned, and it began to hobble about.

The wound healed up gradually, and the animal did not exhibit a single bad symptom during recovery.

Experiment III.—Having exposed and ligatured the right femoral vein of another dog, as in the last experiment, the wound was stitched up ; and then half an ounce of pus, recently obtained from an abscess in a patient suffering from suppurative fever, was injected into it. A considerable amount of blood was lost during the operation, which caused the dog to faint.

On the following day the wound was observed to be swollen, painful, and surrounded by a reddish-green coloration, which extended into the inguinal region. The animal ate no food, but was thirsty.

About 3 A.M. next morning the dog was very restless, whined, and rolled about. He died about thirty-six hours after the operation.

Autopsy.—The wound was cicatrized. The surrounding tissues were much discoloured. The distal end of the ligatured vein was filled with a clot, while the proximal end was empty. There were no signs of phlebitis to be found anywhere. The cavities on the right side of the heart, the venæ cavæ, and the veins of the body, were distended with clots of recent formation; but the walls of the vessels presented no signs of inflammation. There was a small coagulum also in the left ventricle. All the organs were healthy.

Experiment IV.—I injected through a cannula, into the pleural cavity of the same dog as was used in Experiment I., some sand suspended in water. The lung seemed to have been punctured, as air issued out through the cannula; but the wound was valvular. Immediately after the operation the dog's respirations became very laboured, it hung down its head, would not eat, and appeared to be about to die.

Next day the animal was better, and breathed with greater ease. It was very feverish, but ate heartily. There was a considerable amount of subcutaneous emphysema around the wound.

These symptoms were present on the following day, but were not so intense.

On the third day after the operation, however, the animal appeared to be quite well, though the lung of the side operated on did not dilate so fully as the healthy lung.

On the fourth day after the operation a subcutaneous abscess of considerable size was observed at the seat of

the wound, which burst, evacuating grumous fluid and pus. Thereafter the dog breathed freely and began to run about, and by the next day the wound had healed up.

Remarks.—In the first two of these experiments, yeast, which is the most readily attainable ferment, was used with the view, if possible, of exciting in the system a fermentative process. This end was not, however, reached; and local irritation was the only result produced by injecting yeast among the living tissues.

In the third experiment true pyæmic pus was injected, but the quantity employed was too large; and was followed by diffuse coagulation of the blood, which rapidly caused death.

Lastly, from these experiments the following conclusions are drawn :—

I. That yeast induces the same symptoms, and produces the same results as other foreign bodies injected amongst the living tissues of an animal, viz., local irritation terminating in sloughing.

II. That though exposed to the injurious influences of pus and of unhealthy suppurative action, animals are not necessarily infected from this source with the constitutional condition termed suppurative fever.

III. That the injection into the circulation of an animal of a small quantity of pus from a pyæmic patient might possibly induce that constitutional state termed suppurative fever, as discoverable by post-mortem examination.

IV. That even if the symptoms (as far as such are recognisable in animals) and the pathological alterations we have described as characteristic of suppurative fever, could be thus (experimentally) induced in animals, it

would still be unwarrantable to assert that the disease thus produced, and that met with in the human subject, are identical.

We have here, then, presented a very extensive field of experimental research which has been examined by various observers, differing from each other in their conceptions of the nature of this disease, and who, accordingly, undertook separate series of experiments, with all possible varieties of fluids. Their conclusions all point towards the same result, viz., that the symptoms, as well as the post-mortem appearances, which are held to characterise suppurative fever, can, to a certain extent, be induced in animals by the injection of a great variety of different fluids, healthy and putrid, chemical and animal. The bearing of this conclusion on the subject of the etiology of suppurative fever will be hereafter referred to.

It behoves us now to consider the remaining supposed sources of suppurative fever, viz., the presence of pus in the blood, the irritation of the nervous centres, thrombosis or mechanical obstruction, a vitiated condition of the blood, and the existence in the circulating fluid of a latent pernicious principle which has as yet escaped detection.

The Purulent Origin of Suppurative Fever.—Boerhaave was the first to state clearly that he supposed that pus was “sometimes absorbed by the eroded mouths of lymphatic or sanguineous vessels.” The occurrence of such a mechanical transport of pus seemed to Morgagni to be impossible, and he furnished the hypothesis of a degeneration of tubercle as explanatory of the mode in which visceral abscesses were formed. Boerhaave’s theory of a commixture of pus

with the blood was resuscitated at a later date by Carmichael, and supported by Quesnay and Velpeau. These observers concurred in the theory of the absorption of pus by the veins,—which either opened on the surface of the wound, or whose walls were ulcerated; while Hunter, Arnott, Cruveilhier, Tessier, and others, ascribed the presence of pus in the blood to phlebitis, whereby pus was formed by the walls of the veins, and thus entered the circulation, or was produced in the centre of the clots which are invariably met with in this disease. The relation of the lymphatics and of the capillaries to the process of absorption has not yet been well defined. By the experiments of Tiedemann, Magendie, Panizza, &c., this function was distinctly proved to be performed by the visceral lymphatic vessels, which also exercise a certain selective power. In the lymphatic glands, on the other hand, a certain filtration takes place, which is well illustrated by Ricord's observations on the syphilitic bubo. Ricord states, "that suppuration occurs in the inguinal glands in two situations: in the centre of the gland, where the matter is syphilitic and inoculable, and on the exterior, where the pus has no specific properties." Hence pus, as pus, cannot enter into the blood after passing through the lymphatic vessels and glands.

It will be observed, then, that the conclusions of Boerhaave, Morgagni, &c., have been contradicted by the experiments and by the more careful observations of recent writers; so that we are forced to the conclusion, that the existence of pus is not necessary to induce suppurative fever, nor is phlebitis an invariable concomitant of this disease. No one, who has devoted attention to this subject, will maintain that the mere

presence of pus, healthy or unhealthy (furnished, for example, by a single injection), can induce suppurative fever or pyæmia. How often do surgeons meet with instances of the absorption of abscesses of considerable size, unaccompanied by any consecutive febrile symptoms, or even of the evacuation of such abscesses directly into the vessels, through ulceration of their walls, without such cases terminating fatally! The mere intermingling of pus with the blood in the animal economy produces little or no constitutional irritation. How rarely do we meet with suppurative fever in proportion to the numberless instances of wounds in which a large amount of purulent fluid is in constant contact with healthy tissue; and often, doubtless, exposed to absorption by open veins or lymphatics! Experiments, in which pus has been injected directly into the veins, are equally inconclusive. Lebert, Sédillot, Polli, and others, have succeeded sometimes in inducing pyæmia by the injection of pus into the veins, while in other instances they have failed. An additional fact in confirmation of this view concerning the innocuousness of pus is furnished by the circumstance of pyæmia sometimes following wounds which have been closed by primary union. After the employment of acupressure for the arrestment of hæmorrhage, and after a wound has healed, with the production of scarcely a drop of pus—pyæmia may occur. A sufficient number of cases has not yet been collected whereby a comparison may be instituted between the proportion of recoveries after the healing of wounds by rapid union, and that of those in which the process has pursued a slower course, and in which there has been a liberal formation of pus. The fact that wounds may

soak for weeks in collections of putrid fluid without the patient exhibiting the symptoms of suppurative fever, as well as the opposite fact stated above, add perplexity to the various data which stagger the observer, who, for the first time, endeavours to fathom the subject of the etiology of this disease.

Pyæmia ascribed to Constitutional Irritation.—The adynamic character of the symptoms exhibited by suppurative fever impressed especially Travers, Rose, and Brodie, and led them to consider this disease to be an affection of the nervous system—to be the effect of constitutional irritation. Copland, on the other hand, attempted to unravel the mystery of this affection by referring the constitutional symptoms to “the change produced by the morbid matter on the organic system of nerves.” As is the case in other fevers, anxiety, depression of spirits, or any of the many influences which affect the intricate and delicate organism of the human nervous system, doubtless have an injurious effect in rendering the constitution susceptible of impressions in other circumstances harmless. But the origin of pyæmia is not traceable to constitutional irritation alone; and, in very many instances of this disease, nervous complications are absent.

Suppurative Fever caused by Thrombosis or Mechanical Obstruction.—This doctrine has been chiefly elaborated by Professor Virchow. “Capillary embolia,” he says, “frequently give rise to minute deposits in the kidneys, spleen, and substance of the heart itself. When a considerable fragment of a thrombus becomes wedged at a certain point of an artery, it may in its turn crumble away through the onward pressure of the blood, and thus the minute particles, to which this

crumbling of the larger plug gives rise, be conveyed into the small branches into which the vessel breaks up. Thus alone does it seem to me that the fact can be explained, that in the district supplied by an artery of considerable size a number of little deposits of the same sort are found. The secondary abscesses share the same fate as the thrombus—heal or decay.” This theory presupposes the invariable presence of thrombosis at the commencement of pyæmia; but such a coincidence is only occasionally met with. By this hypothesis the local phenomena pathognomonic of suppurative fever, viz., the formation of secondary abscesses in the viscera, are accounted for; but the source of the constitutional symptoms is not thus explained. Savory remarks that “thrombosis may exist without any evidence of phlebitis, and very often occurs without being followed by pyæmia. Phlebitis may occasionally exist without thrombosis, and often occurs without being followed by pyæmia. Pyæmia often exists without any evidence of phlebitis or thrombosis; still oftener it occurs without any evidence whatever that it has been preceded by either of these, or by any other affection of the veins. It has, therefore, not been satisfactorily shown that either phlebitis or thrombosis stands, in any special or peculiar manner, in relation to pyæmia, as cause and effect.”* The ingenious theory of Professor Virchow is, further, opposed by the fact, that uncomplicated embolism, as derived from an apoplectic clot, from atheroma, or from clots caused by mechanical irritation or phlebitis, is followed by fewer points of congestion and stasis, than is the case in sup-

* Savory, in “St Bartholomew’s Hospital Reports, II.,” 1866, p. 46.

purative fever. In the former instance, too, the area of each embolus is wider, and degenerative softenings are less liable to follow. Bristowe, moreover, points out that this embolic theory does not explain cases "starting from some part of the systemic nervous system, in which the lungs escape, whilst secondary deposits abound in other organs." In embolism and atheromatous degeneration of the arteries, says Bristowe, we find "that obstruction of the supplying artery causes, in the part supplied, precisely those lesions which occur as the specific local manifestations of pyæmia."* These phenomena, secondary to both varieties of embolism, differ, however, in the rapidity with which they progress in those respective diseases. It is evident, therefore, that the formation of visceral abscesses is not pyæmia, but that a constitutional derangement takes place, which is indicated by the symptoms previously described.†

Lastly, this theory does not explain the formation of abscesses in the joints, nor in the cellular and like tissues, the structure of which is much more diffuse and less vascular than that of the viscera. Veins not infrequently, also, become the seats of inflammation, followed by the formation of firm coagula, without any pyæmic symptoms being developed.

Some writers on this subject have attributed the formation of the secondary purulent deposits to the infarction or arrestment of the pus corpuscles in the ultimate capillaries of organs. Seeing, however, that

* Bristowe, p. 201.

† E. Wagner refers embolism to fluid fat escaped from the seat of suppuration.

these globules do not exceed in size the white corpuscles of the blood, which do not occasion any such obstruction, this hypothesis is untenable. No doubt a temporary blocking up of capillaries in one part or other of the human body is an every-day occurrence, and is, nevertheless, succeeded by no untoward constitutional disturbance; for the compensatory circulation which is excited in such an instance (as in the case of obstruction of one of the larger vessels of a limb), is quite sufficient to prevent any ill consequence.*

A Vitiated Condition of the Blood, as a Cause of Pyæmia.—Observation and experiment alike prove that the existence of phlebitis and the presence of pus are not necessary for the development of pyæmic symptoms and lesions; but that these are produced by some influence affecting the system, probably through the medium of the general circulating fluid, as is the case with fevers. The fact not having been established that suppurative fever might supervene on diseases in which there was no wound or rupture of tissue, and no formation of adhesive material, the hypothesis was suggested that, instead of pus being absorbed from the wound, the purulent or other fluid there present, coming in contact with the circulating fluid supplied to the wound for its reparation, affected the latter so as to vitiate it, and rendered it the agent for the production of the various

* Professor Billroth of Vienna refers these metastatic abscesses "to embolism, which is rare; or to a response of the central organs to the peripheral nervous irritation." Septicæmia he regards as essentially different from pyæmia, as dependent on the absorption of putrid matters, and as producible in experiments. "In septicæmia," he says, "there are no metastases, no rigors, but extensive purulent infiltration around the wound."

symptoms and lesions pathognomonic of suppurative fever. Lebert ascribed this injurious action to the serum of the pus in the wound; Bérard, to putrid serosity existing in the unhealthy discharges of the wound; Wood, to a zymotic change in the blood from the absorption of sanious products from the wound; Gendrin, to a conversion of pus into blood; and so on.

It is natural to suppose that in suppurative fever, as in cholera, plague, syphilis, febrile affections, and similar systemic diseases, the circulating fluid is more or less injuriously altered in its character by the same causes as those which originate the local affections. The question, however, before us at present is,—whether any more definite alteration than that which occurs in other diseases, any change attributable to the special poison of suppurative fever, can be demonstrated? As far as research has yet gone, the exciting principle of pyæmia, as generated in the discharges from a wound or in the pus of an abscess, has not been detected. But is there any reason to suppose that the primary source—poison—of suppurative fever is to be discovered by quarrying deeper in this mine of research? The reply is furnished by direct observations as well as by analogy. Virchow says,—“In one form of purulent reabsorption, what is absorbed is not pus, but a simple fluid, composed in great part of water, a few salts, a very small quantity of albuminous matter; and there can be no question but that we have here presented to us one of the most incomplete forms of reabsorption. The second form of reabsorption is that which constitutes the most favourable case, when the pus really disappears, and no essential part of it need remain behind. But here, too,

the pus is not reabsorbed as pus, but first undergoes a fatty metamorphosis. Instead of pus in this instance, an emulsive mass, composed of water, some albuminous matter and fat, and in which even sugar has on various occasions been demonstrated," is formed; and it is this fluid which afterwards comes to be reabsorbed.

Now, as to the facts furnished by analogy. Home* communicated measles by means of blood taken from a person affected by them. Duhamel records the case of a butcher who, having put in his mouth the knife with which an over-driven ox had been slaughtered, had his tongue and throat swollen a few hours afterwards, and an eruption of blackish pustules over his body. He died in four days. Another person, having wounded himself in the hand with a bone of the same ox, was seized with inflammation of the arm, followed by mortification and death. Two females experienced also gangrenous inflammation from a few drops of the blood of the same animal having fallen upon the hand of the one and the cheek of the other. Dupuy and Leuret introduced into the cellular tissue and veins of a sound horse blood taken from a horse affected with malignant pustule, and thus produced the disease. "The instances of gangrenous or diffuse inflammation of the cellular tissue, arising from contact or inoculation of putrid animal matter, as recorded by numerous writers; the not infrequent instances of it from injury in the dissecting-room; and the occurrence of putrid fever, with gangrenous pustules and carbuncles, particularly amongst farriers, flayers, and knackers,—furnish

* Home, in "Copland's Dictionary," p. 183.

proofs and illustrations of the blood being one of the chief, although, perhaps, not the primary or only channel through which the whole frame becomes more or less infected in a large and important class of diseases." Such observations, and those which follow, prove that the blood is the source of inoculation with morbid matter; and they, at the same time, negative the probability of the discharges or excretions of such patients being sufficiently potent to be inoculable. "Definite substances," says Virchow, "(as nitrate of silver, urate of soda in gout, and bone earth in mollities ossium), in solution find their way into the blood." Further illustration of this inoculation through the blood is furnished by hydrophobia,—that mysterious disease, dire in its results and obscure in its origin. That surgical and puerperal fevers are owing to a vitiated condition of the blood is held by Sir J. Y. Simpson, who remarks, that "like small-pox, measles, scarlatina, rheumatism, and the other so-called 'disseminated inflammations' of M. Chomel, they cannot be excited artificially by the common causes of inflammation, but are developed by specific causes." They are, in fact, "secondary inflammations resulting from a primary morbid diathesis or alteration of the animal fluids." "Why," inquires Savory, "in the case of every putrid collection in contact with living parts, is there not infection? Because, not only is absorption modified according to the nature and surface of the tissue, but also by the character and composition of the fluid. Moreover, the absorption may be sometimes so gradual as not to exceed the rate of elimination, and therefore not to accumulate in the blood to an extent sufficient to produce obvious results." Observation, then, gives us no encouragement to labour

on with the view of detecting the source of suppurative fever in the discharges of wounds; inasmuch as the substances, obtained by chemical analysis from the fluids reabsorbed in this disease, when injected directly (without being derived from purulent discharges) into the circulation of healthy animals, cause almost no constitutional disturbance. By analogy we are likewise deterred; for suppurative fever resembles more closely those diseases which are induced in animals by the injection into their system of vitiated blood than those inoculable by the discharges or excretions.

The Toxæmic origin of Suppurative Fever.—Similar to, but not the same as the preceding, is the hypothesis concerning the toxæmic origin of suppurative fever. The facts suitable for the establishment of this theory are supplied by two different sources,—by experiments and by chemistry. If suppurative fever, properly so called, can be induced by the injection into the lower animals of blood, pus, or other fluids procured from a patient suffering from this disease, and if it can be induced only in this way, we are forced to the conclusion that one or all of these fluids contain the active principle of the affection. But the greatest possible care is necessary to guard against false conclusions being drawn from this source. There is sufficient proof that certain constitutional diseases, as syphilis, are not inoculable in the case of the lower animals; while, on the other hand, animals can be infected with small-pox by inoculation. One difficulty, however, may always be raised as to inferences deduced from such facts alone, viz., Is the morbid state produced in an animal by inoculation with the diseased fluid of a human patient exactly the

same as that which furnishes the injected fluid ? This can only be proved by the crucial test of first inducing the disease in an animal, and then infecting a healthy human being with the disease from the animal. But the application of such a test is denied to us.

By chemical analysis, an abnormal constituent in any of the fluids of the body can be detected ; and thus provided with the supposed virus, or active principle of the disease, we next endeavour to confirm our conclusions, by observing the action of the supposed poison in the case of healthy animals. Some chemists assert that, as in scarlatina, in cases of exhaustion, of starvation, and the like, there is hypnosis, that is, a deficiency of fibrine in proportion to the blood corpuscles ; others (and this is the view most generally held in the present day) allege the contrary to be the case in suppurative fever. Vauquelin detected hydrosulphate of ammonia in putrid blood, while M. Bonnet of Lyons thinks that this salt exists in the blood of patients suffering from purulent infection, and that the principal symptoms are due to the presence of this substance. Professor Panum declares the poisonous agent in suppurative fever to be fixed, not volatile ; indestructible by boiling and subsequent evaporation to dryness ; soluble in water, insoluble in alcohol, and so intense as to be comparable only with the poison of serpents, curare, and the vegetable alkaloids. He agrees with Weber in stating that filtered putrid fluids and sulphuretted hydrogen never cause infarctus, or metastatic abscesses, and that these lesions occur when morphological bodies of small size, but sufficiently large to obstruct the capillaries, pass into the circulation.

These observers conclude that this disease is septic poisoning, accompanied by some element capable of leading to embolism. Mackenzie held that lactic acid, introduced artificially into the blood, was capable of producing the phenomena of some forms of puerperal pyæmia. Dr B. W. Richardson announced some time ago to the Epidemiological Society, that he had found the poisonous agent in pyæmia to be an alkaloid, which was derived from the decomposition of albuminoid substances. He calls it "septine," and says that it has the power of transforming albuminous substances into matter like itself.

Another consideration regarding the supposed poison of suppurative fever, is its analogy with other animal poisons. This class of toxæmic agents differs from most in the fact, that the effects produced are not proportionate to the dose, as is the case with the poisonous substances furnished by the mineral kingdom. The effects, for example, of a minute quantity of septic animal matter introduced into the system by puncture in dissection, cannot be explained by any mode of operation such as inorganic poisons may be supposed to possess. "With regard to the poison exciting pyæmia," remarks Savory, "as it commonly appears after injuries and operations, although, so far as clinical observation goes, whatever indications there may be, there is no clear evidence that the effects vary as the dose; yet in experiments upon animals, the quantity of putrid matter or pus injected has a manifest and most important influence upon the result." Some animal poisons Savory considers to be formed within the body, and then to pass into the blood; and of this class the poison of pyæmia is a member.

Such is the difference of opinion regarding this one animal poison—the noxious principle of this one fever. Its source is still unknown, its physical characters are as yet undetected, its chemical properties undiscerned, and its dose not yet defined. What is the “poison,” “materies morbi,” “exciting cause” of suppurative fever? Where is it developed, and under what conditions, and in what form does it enter into and reproduce itself in the system? These are problems which still remain to be solved.

CHAPTER IX.

DIAGNOSIS OF SUPPURATIVE FEVER.

WHEN the characteristic symptoms of suppurative fever are well developed—when the conjunctivæ and skin have a dusky, icteric tinge—when the breath has the peculiar “heavy,” “sweet,” “hay-like,” or “purulent” odour—when the joints become inflamed and suppurate—or when secondary abscesses form in various parts of the body,—the diagnosis of suppurative fever is as simple as that of typhus, small-pox, or any of the eruptive fevers. But, especially in the milder forms of the disease, suppurative fever is very frequently not recognised. When pyrexia is experienced four or five days after an operation or a delivery, and is followed by more or less prostration, without any of the above symptoms being well marked, this will probably not be termed an attack of suppurative or of puerperal fever.

The following diseases are those which require to be distinguished from suppurative fever.

1. *Meningitis* is distinguished from pyæmia by Sédillot. It is of very rare occurrence that the cerebral symptoms presented by suppurative fever are so grave or so strongly developed as to be mistaken for those of meningitis. In Case IV. the patient exhibited very violent cerebral symptoms; but the other characters

of the disease were sufficiently distinctive to render the diagnosis far from difficult.

2. The pulmonary affections the symptoms of which are most liable to be confounded with those of suppurative fever, are *bronchitis* and *pneumonia*. Both these forms of inflammation, as we have before seen, are by no means infrequent complications ; but they may of themselves assume a typhoid character, which requires to be distinguished from that of pyæmia. The exhaustion of strength and imperfect oxidation of the blood, which occurs in bronchitis, and especially in pneumonia, may give the patient's skin a sallow, ash-coloured hue, mistakable by the casual observer for the pyæmic tinge. But if the pulse is very rapid and weak, the breath tainted by the characteristic pyæmic odour, and the joints undergoing suppurative changes, the diagnosis is readily made.

Though each abscess commences with a partial pneumonia, "an imperfect examination alone," says Sédillot, "will lead to the confusion of pyæmia with bronchitis, or broncho-pneumonia." I have, however, seen one instance in which it was a matter of extreme difficulty to decide between suppurative fever and pneumonia.

3. "There are other *blood-poisonings*," says Murchison,* "such as erysipelas, pyæmia, jaundice, glanders, &c., where symptoms may appear like those of typhus; but these diseases have distinct characters, which can rarely leave any doubt as to the nature of the case. At the same time, erysipelas, pyæmia, and jaundice may exist as complications of typhus. Speaking generally,

* Murchison, C. A. 1862, p. 216.

it may be said that the only certain means of distinguishing typhus from several other blood-poisonings, is the presence of the characteristic eruption. In certain cases of uræmia, pyæmia, erysipelas, and typhoid jaundice, especially during an epidemic of typhus, it may be difficult to decide whether they are the primary diseases, or are to be regarded as complications of unspotted typhus." It is very seldom, indeed, that *icterus* can during its whole course be mistaken for pyæmia. The golden hue of the more purely hepatic disease is generally in itself sufficiently diagnostic; and it is the coloration of the skin alone which constitutes the resemblance between suppurative fever and jaundice.

4. The periodical character sometimes exhibited by the rigors in suppurative fever may lead to its being confounded with *intermittent fever*. As we have already observed, though other maladies may be mistaken for pyæmia when the diagnosis is based on a single symptom, or the patient is cursorily examined, the *combination* of symptoms presented by suppurative fever is sufficiently diagnostic to prevent error. While, then, the aggregate of symptoms is required in order to sustain the diagnosis of pyæmia from certain other diseases, this combination must not of necessity form the basis of the diagnosis of suppurative fever *per se*, as an individual disease. "Pyæmia may simulate pythogenic fever very closely," says Murchison.* "The absence of lenticular spots, the yellowish tint of countenance, and the circumstances under which the symptoms appear, usually suffice to distinguish the former malady." He includes pyæmia among the sequelæ of

* Murchison, C. A. 1862, p. 526.

pythogenic or enteric fever. Sédillot, also, distinguishes pyæmia from typhoid fever, with which disease he considers it most liable to be confounded. As a complication, and at other times a sequela of typhus, pyæmia has been mentioned by Anderson of Glasgow, and by Murchison, both of whom regard the result in this instance to be invariably fatal "within two or three days."

5. "The nearest affinities of chronic pyæmia," says Paget, "are with *rheumatism* through gonorrhœal or urethral rheumatism." In the instance of J. H. (Case XV.) it will be remembered this error in diagnosis was made, and one could not have met with a better example,—a case in which the symptoms of the real affection were well masked by those of another disease. This patient had intense pain in almost all the larger joints, with feverishness, and a flushed, ruddy face. The only truly pyæmic phenomena exhibited were the presence of pus at the seat of fracture, and a doubtfully purulent odour of the breath. The absence of swelling in any of the joints tended to increase the perplexity of the diagnosis. As a rule, however, chronic rheumatism resembles suppurative fever in only one of its symptoms; and the diagnosis can, for the most part, be readily made out by attention to the other symptoms presented by the case.

6. Lastly. "The general signs of pyæmia," says Paget, "cannot, in every case of this chronic kind, be distinguished from those of *hectic*, or of mere exhaustion; yet, commonly, they are distinct enough, and the distinction becomes very nearly certain when, as it often happens, there appear occasional patches of redness on the skin, as abscesses with fluid walls, or œdema of a

foot or hand, or indications of pneumonia." "I venture," says Hilton, "to reiterate the opinion which I have oftentimes expressed in my systematic lectures on surgery, that the pathological cause of hectic fever associated with chronic abscess, or following its being opened, is absorption of unhealthy fluid engendering pyæmia."

The typhoid symptoms which occur in hectic and in suppurative fever bear a certain resemblance to one another, but only in so far as they indicate in each instance the strain to which the constitution is exposed, and the connection of the constitutional affection with local suppuration.

But, as Bristowe remarks,*—"The diagnosis of pyæmia is not generally difficult, if the circumstances of the case and the symptoms be all considered. Still, its own symptoms are often so mixed with those of the disease out of which it arises, or with those of the complications which become developed during its progress, and are so often modified by them, that the pyæmia may be recognised with difficulty, or even wholly overlooked; and, further, there are several diseases with the symptoms of which its own have a divided, and even close affinity, and with which, therefore, it is apt to be confounded."

In short, the symptomatology of suppurative fever bears, at first, some resemblance to that of many other diseases, seeing this affection is sequent on a great diversity of morbid states of the body. When it becomes more developed, and when its symptoms are studied in combination and not singly, an error in the diagnosis of suppurative fever will be almost impossible.

* Bristowe, p. 218.

ANALOGY WITH OTHER DISEASES.

Suppurative and puerperal fevers have been considered in a former part of this treatise, not only as analogous, but as essentially identical,—in fact, as diseases due to the same poison, though engendered in two different constitutional conditions.

Pyæmia is, however, grouped in many surgical works with erysipelas, diffuse inflammation of the cellular tissue, and other inflammations of a low or asthenic type. From the preceding remarks it will be very apparent that the analogy between erysipelas and suppurative fever consists only in both diseases being febrile attacks, in both being accompanied by a certain discoloration of the skin, and followed by secondary abscess formation. They are, nevertheless, essentially different. Erysipelas is an eight-day fever, the poison of which acts most virulently on the skin and serous membranes. The “*materies morbi*” of suppurative fever decomposes the blood, and induces secondary changes in the vascular pulp of the viscera without affecting the serous coverings. Professor Sir J. Y. Simpson, and other obstetric writers, mention instances of puerperal fever and erysipelas being convertible, and induced separately from the same source. No example of such a mutual convertibility of erysipelas and suppurative fever has yet been published. It is very doubtful whether even, in the former case, some error has not been committed, or theory been allowed to prevail over observation. Erysipelas and suppurative fever differ further in this respect, that the former is contagious while the latter is not.

PROGNOSIS IN SUPPURATIVE FEVER.

Most writers on pyæmia, and most surgeons, even in the present day, consider suppurative fever to be almost invariably fatal. Nélaton, for example, says this disease is invariably fatal. "Death is the most ordinary result," remarks Velpeau; "but diarrhœa, increased secretion of urine and sweating, leading to recovery, sometimes occur."* "In surgical practice," says Bristowe, "nearly all pyæmic cases die; in midwifery practice a larger proportion probably recover. The disease is one of the most fatal with which practitioners have to deal. Its premonitory symptoms are ground for the gravest alarm, and from a fully developed and unmistakable attack recovery is almost quite hopeless."† Some observers, however, take a more hopeful view of this disease. "We believe," says Sédillot, "that pyæmia is among the most common complications of suppuration, only that it is frequently overlooked, from the false idea which exists, that every case of purulent infection must be accompanied by metastatic visceral abscess." Vidal, Blandin, Velpeau, and others, have published some cases of recovery. "We may," continues Sédillot, "reassure practitioners by telling them that such ought to be the ordinary result of well-directed treatment. Pyæmia is of infinitely more frequent occurrence than is generally admitted, and for the most part terminates successfully. Incurability is the exception; and far from proclaiming the

* Velpeau. "Leçons Orales de Clin. Chirur," 1841, p. 79, vol. iii.

† Bristowe, pp. 217, 218.

powerlessness of art, we believe it possible to throw far back the limits of its applicability, and yet extend its resources."

Savory and Callander give a very gloomy prognosis. Savory remarks that the prognosis in this affection is not encouraging. "Of all diseases," he says, "which the surgeon has to encounter, pyæmia is the most destructive and the worst. When it occurs, recovery is comparatively so rare—and it (the disease) does occur so frequently—it is often so sudden and unexpected in its onset, often so insidious in its progress, and often kills so rapidly, that it is justly regarded by surgeons as the most mischievous of evils. It very often defies all efforts of prevention, and seems hardly ever to be influenced by any attempt to cure. Seldom giving any warning of its approach, it will at once convert a case, which just before seemed full of promise, into one past all hope of recovery; for it cannot be denied that, with rare exceptions, to pronounce a patient the subject of pyæmia, is to say that he is a doomed man. The prognosis in pyæmia," he continues, "may be said to be unfavourable in proportion to the rapidity with which its effects are developed. In acute and well-marked pyæmia one can hardly venture to admit a ray of hope. On the other hand, as a general rule, the longer the patient can struggle against the mischief, the more chance is there of his being ultimately rescued from the perils through which he has to pass." "Few recoveries from the secondary complications are recorded," says Callander, "and even in these the symptoms mark an early stage, when the existence of this disease has been suspected rather than proved. Indeed, pyæmia is depen-

dent upon a state with which life can scarcely be prolonged; so that even if the secondary abscesses did not interpose and hasten the end, death would none the less result from the exhaustion consequent upon the original mischief."

Before forming his prognosis, the practitioner ought carefully to ponder over the symptomatology, pathology, and etiology (as far as known) of a disease, and from these draw conclusions as to its nature and probable termination. The symptoms, then, of suppurative fever are those of a fever having certain distinguishing features which are essentially of the adynamic type. But do not typhoid symptoms accompany many other diseases, and most fevers when they are virulent? Nevertheless, the prognosis in such instances is not "invariably fatal." The pathology of suppurative fever exhibits serious visceral lesions, diffuse in their distribution, and rapid in their formation. In tubercle, likewise, are not all the organs of the body liable to suppurative degeneration; and do we not often meet with patients in whom large pulmonary vomicae have cicatrised? Enteric fever is accompanied by ulcerations which are both numerous and of considerable size and depth; "but patients have occasionally recovered," says Murchison, "after all the symptoms of peritonitis from perforation."* Is it correct, then, to say that pyæmia is dependent upon a state in which life can scarcely be prolonged? Pathological lesions as serious, as diffuse, and often of nearly as rapid development as those connected with suppurative fever, are met with in other diseases, and the prognosis has not in the latter instances been regarded as so "doubtful." As far as is at present known, the etiology

* Murchison, p. 535.

of suppurative fever points to some morbid agency acting on the blood. And this also is the extent of our knowledge of the causation of other fevers. The pyæmic poison is as yet undetectable; it is frequently reproduced during the progress of the disease; and it operates with variable degrees of virulence in different instances. But does not the same hold true regarding the "*materies morbi*" of other fevers?

We are compelled, therefore, to model our prognosis from the same data as those on which the prognosis of other fevers is based. Suppurative fever resembles other febrile affections in its etiology, symptomatology, and pathology. It presents different degrees of severity, being sometimes so slight as not to be recognised, or to be mistaken, while at other times it is rapidly fatal. Age also affects the prognosis; for youth is highly favourable to recovery from pyæmia. One point of dissimilarity, however, must not be overlooked—that suppurative fever is more commonly a secondary than a primary disease: hence the patient's constitution is more or less undermined by other causes than those which are properly pyæmic. The rate of mortality is another basis on which the prognosis of other fevers is founded. But this cannot at present be taken into account; a sufficiently large number of instances of recovery from suppurative fever has not yet been published to enable any deduction to be drawn from this source. Every surgeon, doubtless, both in hospital and in private practice, meets with numerous examples of pyrexia following on the fourth or fifth day after an operation, and characterised by several of the symptoms of suppurative fever. How often, after such a febrile state, are the edges of

the wound observed to have an erythematous blush, while its surface becomes unhealthy and indolent-looking, and the discharge scanty and sanious! A pneumonia is detected, the erythema extends and involves a considerable part of the body, some of the joints perhaps suppurate and discharge, and the patient is considered to be suffering from suppurative fever. Thus he may continue for two or three months, and yet recover; and because he has recovered, the surgeon begins to think that he has made an error in diagnosis. It appears to me more consistent to believe that suppurative fever may present an infinite variety of such forms—may vary in degree just as other fevers do—than to regard this disease as that acute febrile affection sequent on injuries and operations, which, accompanied by pneumonia, terminates fatally in a fortnight or earlier. Slight and transient disturbances of the system, evoked, I believe, by the poison of suppurative fever, are of almost every-day occurrence, but are either otherwise accounted for or altogether overlooked. In short, the prognosis in this disease depends not only on the severity of its action (in any individual instance), but also on the nature of the affection which preceded the pyæmic attack, and on the extent to which the constitution had fallen a prey before suppurative fever set in. It cannot be too urgently enjoined on surgeons that the prognosis ought not in all cases to be necessarily unfavourable; on the contrary, hope of recovery should be maintained to the last. If the strength of the patient can be supported sufficiently, and if the other means of treatment before prescribed are assiduously carried out, the prognosis in suppurative fever ought to be considered as encouraging as in the case of other fevers.

CHAPTER X.

FACTS AND CONCLUSIONS.

IN bringing this treatise to a close, it will be advantageous to collect together all the facts at our disposal which may enable us to obtain a better knowledge of this insidious and seriously mortal disease—suppurative fever.

Suppurative fever, then, may originate *de novo*; but it is almost always associated with some local supuration. It is impossible to determine absolutely whether such a local affection (as in Cases XII. and XV.) bears the relation of cause or of effect to the visceral lesions; but it seems to me to form part of the other pathological alterations met with in this disease, and hence is an effect, and not the cause. The contents of such local inflammations consist generally of unhealthy pus; and this serves to strengthen the supposition of their secondary development. Suppurative fever supervenes most frequently after injuries or operations in which bones are involved. It occurs, also, very frequently in cases in which the veins are specially implicated. The supervention of venous hæmorrhage after an operation is, on this account, to be regarded as a most serious complication; and the thin-walled veins in bones, the patent intracranial sinuses,

the proximity to and almost direct communication of the eye and ear with these sinuses, the existence of venous plexuses around such viscera as the prostate, and the patulous state of the uterine veins after delivery, should be borne in mind when operations are performed on these parts, or when suppuration affects them.

Suppurative fever generally supervenes on the third, fourth, or fifth day after an operation; but sometimes weeks, or even a month, may elapse before it sets in; the stump or wound which formed the source of local suppuration may have completely healed up, or nearly so. In not a few instances, the signs which indicate the invasion of the system by this fever have been observed to occur a few hours after the separation of the ligatures. This circumstance favours the hypothesis of an absorption of morbid matter from the wound through the agency of the blood-vessels.

Suppurative fever, in its symptoms, prognosis, pathology, and terrible mortality, is analogous, on the one hand, to certain contagious fevers, as typhus, diphtheria, &c.; and, on the other, to certain diseases arising from the inoculation of animal poisons. But it differs from these analogous morbid states in its being non-contagious, and in not being propagable by media, except perhaps in isolated cases, where a raw, suppurating, or sloughing surface is present. It, however, occasionally attacks so many individuals at once as to cause the disease to be regarded as epidemic; and this effect may be ascribed to gaseous emanations, or, according to modern doctrines, to inappreciable atmospheric germs.

The morbid principle—"poison"—of suppurative fever is more generally diffused and subtle than the

poison of other diseases. It cannot be associated with any one special predisposing condition. It manifests its power in most opposite and under seemingly most adverse circumstances.

The secondary abscesses, which indicate the influence of the poison of this affection on the system, are met with in all the organs and tissues of the body ; but it may be noticed frequently, that the more chronic the disease is, the less marked are these post-mortem appearances. These pathological lesions exhibit no definite relationship to the symptoms present. They progress sometimes with fearful rapidity, destroying large portions of organs in a short space of time, and thus causing hæmorrhages ; at other times they appear to be in the incipient stage, though the patients have suffered for weeks or months from the fever ; and, in a third class of cases, they are accompanied by symptoms indicative of extensive destruction of tissue, while, after death, no material alteration in the appearance of the organ is observable.

It is a remarkable fact, which dare not be overlooked, that suppurative fever is scarcely ever (I might say never) coexistent with any of the cachexiæ. I have met with no instance, nor with any record of a case in which the pathological lesions characterising the tubercular and cancerous cachexiæ (for example) were found after death in conjunction with secondary purulent deposits in the viscera, the results of suppurative fever.

The symptoms diagnostic of pyæmia are met with, to a certain degree, in other diseases. The pyæmic coloration of the skin and conjunctivæ is pathognomonic when well pronounced, but it resembles closely the tinging of the skin observable in wasting diseases. The

odour of the breath—"purulent," "sweetish," "hay-like"—is considered by some observers to be identical with that met with in hepatic diseases generally. Lastly, the symptoms which accompany the accession of the various secondary affections have been mistaken for those of rheumatism, and for the results of erysipelas and diffuse inflammations. Suppurative fever may be, and also has been mistaken, and even overlooked. Its symptoms are diagnostic when considered in a group, but individually they are analogous to those of many other affections. Even as regards the local symptoms, the fickleness of suppurative fever is often noticeable. A wound looks healthy, sometimes, until almost the termination of the disease; a stump often heals kindly, though the symptoms of suppurative fever are well developed; and one may, at other times, observe one joint to be affected, to suppurate, discharge, and heal up, and then another becomes invaded by the suppurative condition. So that the larger joints may become the seats of serious changes consecutively and individually, instead of being all involved at the same time.

Suppurative fever is met with secondarily to head injuries, to the graver as well as the more trivial surgical operations, to diseases in which pus is formed as well as those unaccompanied by the formation of pus; and it has been known to follow almost every morbid condition—local as well as constitutional—(with the exception of such as result from specific cachexiæ), from which the human body can suffer. This point is illustrated by Table II. of the Statistical Appendix. It attacks more commonly the strong and healthy than the enfeebled and weakly, even when both have submitted to the same operation.

The causes and circumstances which predispose to suppurative fever are, probably, the same as those which precede many other constitutional diseases, especially the class of fevers. The exciting cause is some morbid alteration of the blood, whereby this fluid is rendered extremely coagulable. To attempt to refer the constitutional condition to phlebitis, thrombosis, toxæmia, and like sources, is only to involve the subject in inextricable meshes of contradiction. Experimental research in animals only adds to the uncertainty which is already sufficiently great. Symptoms, which have been considered identical with those of suppurative fever, are produced in animals by the introduction into their circulation of a very great variety of substances differing from each other in their physical properties, in their chemical nature, and in their physiological actions on the system; and pathological lesions, which are held to be characteristic of the earlier stages of this affection, are discovered in such animals after death. If, then, very various, even opposite substances, produce in the system identical results, how is the special "*materies morbi*" of suppurative fever to be distinguished?

Furthermore, this fever, as is fully shown in the pages on the spontaneous and contagious origin of suppurative fever, breaks out under very various hygienic conditions. In one instance it rages in a ward crowded with operation cases; while, in another, it seems to pass by this one and attacks a well-ventilated ward, in which there is only a very small proportion of suppurating wounds. Again, of several wards on the same floor, and apparently exposed to the same infecting principles, one only becomes the seat of the depredations of this affection. In another instance, the exciting cause—poison—

of this disease, appears to confine its energy to one among a number of subjects, apparently equally favourable for its attack.

In fact, suppurative fever, in its invasion, exhibits often an absence of all respect to time. It presents no evidence that there is one *single* infecting principle which may be regarded as its exciting cause: it occurs after very various morbid conditions: it sometimes ravages the viscera of the system rapidly; while, in other instances, it seems to smoulder in the blood, and to cause death by gradual prostration of the vital energies. It may leave traces of its invasion in individual viscera or in several viscera; and, while defying all efforts at prevention, seldom even giving any warning of its approach, "it will at once convert a case which just before seemed full of promise into one past all hope of recovery."

CONCLUSIONS.

I. This disease has been more or less recognised since the days of Hippocrates.

II. Pyæmia, in all its characters, is more nearly allied to febrile affections than to any other class of diseases with which we are acquainted. It is a fever, and by the use of the name *Suppurative Fever*, the nature of the disorder is indicated.

III. The name *Suppurative Fever* is preferable to the current one *Pyæmia*, inasmuch as the former term is connected with the pathology of the disease, which has always been, and will always remain the same; while the latter term has been adopted because of its supposed origin being the admission of pus into the circulation.

IV. Suppurative fever is generally ushered in by rigors, and it is characterised by certain definite diagnostic symptoms, viz., profuse perspirations, a yellowish and sallow coloration of the skin and conjunctivæ, a peculiar "heavy" or "sweetish" odour of the breath, extreme prostration, a weak and variable pulse, the development of secondary subcutaneous abscesses and articular inflammations, stagnation of the wound, and a discharge sanious, foetid, and of a bluish-green colour. Collectively these symptoms are pathognomic; but they are separately met with in very many other diseases. The typhoid nature of the symptoms, for example, renders them very analogous to those induced by certain animal poisons; the multiple abscesses are like those which occur in plague, syphilis, variola, &c.; and the blood may in other affections of the system also be loaded with corpuscles identical with pus globules.

V. Suppurative fever exhibits two sets of symptoms, viz., those indicative of the acute and those of the chronic disease. The latter form of the fever presents, moreover, three varieties, viz., subacute, idiopathic, and relapsing. These terms are in themselves sufficiently well understood to render any definition unnecessary.

VI. This disease is divisible into four stages:—the stage of Incubation, the stage of Invasion, the Typhoid stage, and Convalescence. These stages are always more or less marked; but their duration, from the deficiency of observations at present existing on this point, cannot be definitely stated. They generally commence, however (as far as my observation goes), and terminate on the seventh or eighth, fourteenth or fifteenth, twenty-first or twenty-second, and twenty-eighth days of the fever.

VII. The treatment which, based upon a careful

consideration of the nature of this disease and on experience, is likely to be successful, consists in supporting the system by the exhibition of an abundance of easily-digested food, of stimulants, and of tonics; while, locally, strict attention to cleanliness and the use of disinfectants are necessary. At the same time, it is of great advantage to pay attention to hygienic measures, and to isolate patients suffering from suppurative fever.

VIII. Suppurative fever commences with a morbidly coagulable condition of the blood, and is characterised by the formation of secondary abscesses in the viscera and various tissues of the body. The purulent deposits, as well as the coagula observed so frequently in the veins after death from this disease, are due probably to the coagulable character of the blood. These secondary lesions appear at first as minute spots of congestion, serum or lymph is next effused, and pus is lastly formed. When fully developed, they are abscesses surrounded by a distinct zone of congested vessels. They occur most frequently in the lungs, and oftener in both lungs than in either separately; their next most common seat is the liver, then the kidneys, then the spleen, joints, cellular tissue, muscles, brain, heart, blood-vessels, bladder, intestines, and organs of special sense. The erythema-like blush, frequently observed on the margins of wounds in this disease, is owing to congestion and embolism of the superficial cutaneous capillaries.

IX. The various circumstances (such as bodily fatigue, shock, hæmorrhage, and the absence of hygienic measures), which predispose to other diseases, may be regarded as predisposing causes of suppurative fever; but the special exciting cause of this affection is unknown.

The visceral lesions observed after death are traceable to embolia or rather to emphraxis, resulting from the excessive coagulability of the blood, and are accordingly to be ascribed secondarily to the irritative action of septic matter about to be eliminated by the organs and tissues. This "*materies morbi*" is either imbibed by the system, or produced originally in the blood. Suppurative fever, moreover, is seldom or never coexistent with any cachexia, and does not require the presence of pus for its development.

X. Suppurative fever is non-contagious, and as a rule not inoculable.

XI. The longer the patient's strength lasts, the better is his chance of recovery from suppurative fever; but in forming a prognosis in this disease, the fact must be borne in mind that this is a secondary not a primary fever—that it invades the system of a patient who has been already exhausted by wasting illness or by a serious operation. The prognosis must also depend on the severity of the attack, on the nature of the disease which preceded its accession, and on the extent to which the constitution of the patient has suffered from the previous illness or accident. Bearing these various points in mind, if the strength of the patient is supported, and the proper means of treatment already prescribed are attended to, the prognosis, in a case of suppurative fever, ought to be as favourable as in the case of most other fevers.

XII. From experimental research, we learn that very diverse substances introduced into the blood-vessels of dogs produce very similar results,—that thus symptoms and pathological lesions, like those observable in the incipient stage of suppurative fever, may be induced; but

that suppurative fever proper—a disease *sui generis*—cannot be thus produced in animals; and that, consequently, the so-called results derived from this source are very fallacious, and should not be taken into account in the study of this affection. Suppurative fever resembles many other morbid conditions, in its not being induced in animals by the injection of morbid fluids. Pus may commingle and circulate side by side with the blood in the vessels; but though it may cause constitutional disturbance, it does not necessarily prove fatal.



APPENDIX OF STATISTICS

The following Tables are intended to show—*Firstly*, That suppurative fever exhibits a certain periodical character ; that exacerbations or improvement occurs at intervals corresponding to the seventh or eighth, fourteenth or fifteenth, twenty-first or twenty-second, or twenty-eighth days after the rigor, which may be considered to indicate the accession, or after the operation, which may be supposed to have excited the fever. *Secondly*, The various diseases, injuries, and operations which have been followed by suppurative fever. And, *thirdly*, The proportionate frequency with which the various viscera are affected :—

TABLE I.

No. of the Case.	FORM OF PERIODICITY EXHIBITED.
1.	Exhibited the first pyæmic symptoms on the second day after venesection ; and died on the fifteenth day thereafter.
2.	Died on the twenty-eighth day after the first pyæmic symptoms showed themselves ; and on the twenty-ninth day after venesection.
3.	Died on the tenth day after the first rigor occurred ; and on the twenty-first after venesection.
4.	Died on the fifth day after the first pyæmic symptoms showed themselves ; and on the twenty-second after the first venesection.
5.	Died “ in the course of the seventh week after venesection.”
6.	„ on the twenty-second day after venesection.
7.	„ „ thirtieth day after venesection.
8.	„ „ fourteenth day “ after the vein was wounded.”
9.	„ “ at the end of the third week.”

No. of the
Case.

FORM OF PERIODICITY EXHIBITED.

10. Died on the seventh day after venesection.
11. „ „ twenty-first day after the occurrence of secondary hæmorrhage.
12. Died on the seventh day after the first rigor was experienced.
13. Is not distinctly reported.
14. Died on the fourteenth day after amputation of the thigh.
15. „ thirty days after amputation.”
16. „ on the eighth day after the first phlebitic symptoms were developed.
17. Is a case of phlebitis.
18. Died on the fifteenth day after amputation.
19. „ about a month after amputation.
20. „ on the tenth day after amputation.
21. „ nine days after amputation.
22. The date is not given.
23. Died “on the fourteenth day after the accident.”
24. „ „ twenty-eighth day after the accident.”
25. „ „ twelfth day after the accident.”
26. „ „ sixteenth day” after receiving the injury on the head.
27. Died on the twenty-first day after the accident.
28. „ „ eighth day after the first rigor was experienced.
29. „ „ fourteenth day” after the accident.
30. Experienced febrile symptoms on the fourteenth day after the accident.
31. Died on the twenty-second day after the accident, and the eighth day after the first rigor.
32. Died “at the end of the fifth week” after the accident.
33. „ on the seventh day after the first rigor.
34. „ „ twenty-ninth day after the accident, and the fever set in on the seventh day after the accident.
35. Died “on the twenty-fifth day” after the accident.
36. „ „ twenty-ninth day” after the accident.
37. „ „ fifteenth day” after the accident.
38. „ „ seventh day after suppurative fever set in.
39. „ „ twenty-second day after suppurative fever set in.*

* These are the cases of pyæmia recorded by Arnott, in the “*Medico-Chirurgical Transactions*,” vol. xv. 1829, pp. 13, *et seq.* Several of Mr Arnott’s cases are not recorded here, inasmuch as they are not sufficiently fully reported to be of use in the illustration of the topic of this table.

No. of the Case. FORM OF PERIODICITY EXHIBITED—*continued*.

40. Died on the eighth day after the first rigor was experienced.
41. Death is not noted in this instance.
42. Began to convalesce on the fifteenth day, dating from the occurrence of the first rigor. The "turn" or crisis occurred on this day.
43. Is imperfectly recorded.
44. Died on the seventh day after the commencement of pyæmia.
45. „ „ third day after the commencement of pyæmia.
46. Is imperfectly recorded.
47. Died on the twenty-second day after the commencement of pyæmia.
48. Is imperfectly recorded.
49. The pyæmic symptoms set in on the eighth day after herniotomy, and death occurred four days later.
50. Is imperfectly recorded.
51. Died on the eighth day after the accession of pyæmia.
52. „ „ twenty-second day after the accession of pyæmia.
53. Died exactly a month after the accession of pyæmia.
54. „ three weeks after pyæmia set in.
55. Died on the twenty-second day after the accident.
56. „ „ fourteenth day after the reception of the injury.
57. „ at the end of about three weeks after amputation.
58. Is imperfectly recorded.
59. Died on the twenty-ninth day after the accident.
60. „ „ eighth day after pyæmia set in.
61. The fever set in on the eighth day after the operation of "ligature of hæmorrhoids," and proved fatal four days later.
62. Died on the thirteenth day after the accident, and the third after pyæmia set in.
63. Died on the eighth day after the pyæmic symptoms showed themselves.
64. Is imperfectly recorded.
65. Died on the nineteenth day after the operation for hæmorrhoids, and the ninth day after pyæmia set in.
66. Died on the twenty-third day after the appearance of pyæmic symptoms.*

* Some of Mr H. Lee's cases have also been omitted, either because they are very vaguely recorded (such terms as "a few days," "a short time," being used), or because they are not sufficiently accurately reported to be of any value for our purpose. H. Lee on "Inflammation of the Veins," pp. 73-82.

No. of the Case. FORM OF PERIODICITY EXHIBITED—*continued.*

67. Died seven days after catheterism.
68. Experienced the first rigor twenty-eight days after amputation, and died twelve days later.
69. Died twenty-eight days after amputation, and on the eighth day after the pyæmic symptoms became well pronounced.
70. Died twenty-one days after the first rigor.
71. Had rigors seven days after the operation, and died five days later.
72. Died fifteen days after the operation, and eight days after the first marked symptoms of suppurative fever were developed.
73. Died eight days after the first rigors were experienced.
74. „ fifteen days after the accession of suppurative fever, as indicated by rigors.
75. Died seven days after the commencement of the fever.
76. „ twenty-eight days after amputation.
77. „ on the seventh day after the first rigor occurred.
78. „ four days after the symptoms of suppurative fever were first observed.
79. Experienced the first rigor on the fifth day after amputation, and died at the end of the seventh week.
80. Exhibited the first symptoms of pyæmia fourteen days after the operation, and twenty-one days later convalescence set in.
81. Experienced the first rigors on the fifth day after amputation, and died on the eighth day after the pyæmic symptoms were well developed.
82. Died seven days after the pyæmic condition became well marked.
83. Experienced the first rigors twelve days after amputation, and died five days later.*

Remarks.—This table appears to me to furnish sufficient proof that the occurrence of death or of convalescence—of exacerbation or of amendment—at weekly periods after the

* Cases 1–39 inclusive are collected from Mr Arnott's series, reported in the "Medico-Chirurgical Transactions;" while cases 40–66 are taken from Mr H. Lee's work on "Inflammation of the Veins;" and the remainder of the cases which compose this table are those recorded in Chap. III. of this work. I have omitted three of my cases, whose history had not been fully obtained. These cases, derived from various sources, were narrated without any reference to the use now made of them, viz., the illustration of the periodicity of this disease.

supposed accession of suppurative fever is not to be regarded as a mere coincidence. It is, in fact, a point which deserves further investigation, and which will become one of the greatest importance in the study as well as in the prognosis of this disease. Suppurative fever, like other febrile affections, has no doubt a crisis, and by attentively watching cases as they occur, this period will be by-and-by discovered.

TABLE II.

Disease, injury, or operation.	Authors mentioned by—
Abscess, acute	{ Lee, Velpeau, Savory, Callander, Wilks, and Chap. III.
„ chronic	Savory, and Wilks.
Amputations	{ Arnott, Lee, Savory, Solly, Velpeau, Gam- gee, Bristowe, Wilks, and Chap. III.
Application of the cauter	Velpeau.
Blistering	Velpeau.
Blow below the knee	Savory.
Bruises	Lee, and Bristowe.
Burns and scalds	Bristowe, and Wilks.
Calculus vesicæ	Wilks.
Carbuncle	{ Bristowe, Savory, Wilks, P. Hewitt, and Chap. III.
Caries	Lee, Savory, and Wilks.
Catheterism	Chap. III.
Cellulitis	Wilks.
Cholera	Duplay.
Cutaneous eruptions	Castelnau and Ducrest.
Diarrhœa	Berthelot.
Dilatation of os uteri	Simpson, and Marion Sims.
Discharge from left ear follow- ing measles	{ Savory, and P. Hewitt.
Disease of the ear	Wilks and <i>Lancet</i> of Feb. 2, 1861.
Dislocation	Solly.
Dissecting wounds	Bristowe, and P. Hewitt.
Empyæma	Callander.
Eroding ulcer of spleen	Callander.
Erysipelas (in children)	Landouzy.
„ (phlegmonous)	Bristowe.
Excisions of joints, tumours, &c.	{ Lee, Arnott, Savory, Gamgee, Vel- peau, Erichsen, Wilks, S.E. Cooper, Chap. III. and <i>Lancet</i> of Jan. 16, 1858.
Extravasation of urine	Wilks.
Fever, yellow	Castelnau and Ducrest.

TABLE II.—*continued.*

Disease, injury, or operation.	Authors mentioned by—
Fever, typhoid (or enteric)	{ Bristowe, P. Hewitt, Murchison, Castelnau and Ducrest.
„ typhus	{ Anderson, Castelnau and Ducrest, Milroy, and Murchison.
„ rubeola	J. T. Banks.
„ scarlet	{ Anderson, Bristowe, Castelnau and Ducrest.
„ milk	Castelnau and Ducrest.
„ puerperal (one form)	Bristowe.
„ variola	Ancell, Boerhaave, and Sydenham.
Fractures, simple	{ Lee, Wilks, Chap. III., and <i>Lancet</i> of May 25, 1867.
„ compound	{ Lee, Savory, Callander, Gamgee, Solly, Wilks, and Chap. III.
„ into joints	Savory.
„ of skull	Gamgee, Savory, and Wilks.
Glanders	Castelnau and Ducrest.
Gonorrhœa	P. Hewitt, Savory, and Wilks.
Hæmatocle	Savory.
„ (uterine)	West.
Herniotomy	Lee, and Savory.
Hydatids in omentum	Callander.
Hydrocele (tapped)	Travers (p. 14).
Inflammation of bursa	Lee.
„ diffuse	{ Bristowe, Callander, Hawkins, and Savory.
„ of glands, &c.	Callander, Lee, and Savory.
Injuries of the head, wrist, leg, knee, &c.	{ Arnott, W. S. Kirkes, Lee, and Wilks.
Laceration of vagina, &c.	Savory.
Ligature of hæmorrhoids	Bristowe, Lee, and Chap. III.
„ „ nævi	Savory.
„ „ subclavianforaneurism	Savory, and <i>Med. Times and Gazette</i> of Sept. 15, 1860.
„ „ the funis	Bristowe.
„ „ veins	Bristowe.
Lithotomy	Rose, Savory, and Wilks.
Lithotrity	Savory.
Necrosis, acute	{ Bristowe, Gamgee, Savory, Wilks, and T. Smith.
Operation for fistula in ano	{ Savory, Solly, and <i>Med. Times and Gazette</i> , vol. i. 1865, p. 60.
„ „ varicose veins	Bristowe.
Ophthalmia	Legallois.
Parotitis	Velpeau.
Parturition at full period	Savory, and Wilks.
„ with partial rupture of perineum	{ Savory.
Pelvic cellulitis	Callander.
Periostitis	Murchison.
Phlebitis	{ Bristowe, Castelnau and Ducrest, and Wilks.

TABLE II.—*continued.*

Disease, injury, or operation.	Authors mentioned by—
Phlegmasia dolens	{ <i>Med. Times and Gazette</i> of Nov. 26, 1859; and <i>Edin. Med. Jour.</i> of Sep. 1863, and Feb. 1866.
Plague	Castelnau and Ducrest.
Purpura	<i>Med. Times and Gaz.</i> of July 27, 1861.
Pustule, malignant	Bristowe, and Velpeau.
Rheumatism	Callander, W. S. Kirkes, and Steffens.
Removal of loose cartilage from knee-joint	{ Rose.
Scar	Wilks.
Scratch of the foot	Savory.
Seton used	Velpeau, and Wilks.
Sloughing of abdominal wall	Lee.
Sloughing wound	Wilks.
Sounding, and injection of bladder	{ Savory.
Stricture of rectum (divided)	{ Savory, <i>Med. Times and Gazette</i> , vol. i. 1865.
" " urethra	Wilks.
Suppuration of internal ear	Bristowe, P. Hewitt, and Chap. III.
" " eye	Bristowe, and Wilks.
" in one tonsil, knee, prostate, &c.	{ P. Hewitt, and Savory.
Synovitis of knee	Savory.
Ulcer of leg	Savory, and Wilks.
Ulcerative inflammation of mit- ral valve of heart	{ Savory.
Vaccination	Wilson.
Venesection	{ Arnott, Bristowe, Gamgee, Lee, and Velpeau.
Whitlow	P. Hewitt and Savory.
Wounds of veins	Arnott, and Savory.
" into joints	Chap. III.
" on the finger, and then attended a fa- tal midwifery case	{ Savory, and <i>Med. Times and Gazette</i> , vol. i. 1865.
" of hand, scalp, &c.	Savory.
" gunshot	Callander, and Martini.

TABLE III.

CAVITIES AFFECTED.	AUTHORS MENTIONED BY—									
	Arnott.	Séillot.	Chevers.	Callander.	Lee.	Erichsen.	Velpeau.	Chap. III.	Wilks	Billroth.
Thoracic cavity affected,	16	101 in 120	100	27	17	48	14	10	103	12
Do. not examined, .	3	...	...	...	...	...	...	...	...	...
Do. not noted, .	2	...	...	...	...	...	...	...	...	...
Do. healthy, .	2	...	...	...	...	...	...	...	...	...
Cranial cavity affected, .	5	...	35	8	7	...	1	4	6	..
Do. not examined, .	9	...	...	...	...	...	...	...	...	...
Do. healthy, .	3	...	...	...	...	...	...	...	...	...
Abdominal cavity affected,	27	1 in 12	70	20	16	...	13	7	52	...
Thoracic and abdominal cavities affected together, . . .	6	...	...	...	...	...	...	...	45	...
Total number of each author's cases, . . .	50	147	134	31	29	62	12	13	113	14
ORGANS AFFECTED.										
Lungs, . . .	10	99 p.c. 1 in 20	47	23	...	...	9	10	98	12
Heart, . . .	1	...	...	4	...	...	1	...	7	...
Pleura, . . .	...	...	35	...	...	...	4	...	61	...
Pericardium, . . .	...	...	14	...	...	...	...	...	3	...
Joints, . . .	4	...	3	6	8	...	2	3	24	5
Blood-vessels, . . .	7	...	..	...	4	...	5	2	11	...
Glands, . . .	...	...	...	...	...	...	1	1	1	...
Liver, . . .	3	1 in 12	...	7	3	...	8	4	21	...
Kidneys, . . .	1	...	...	7	7	...	1	5	23	1
Spleen, . . .	1	1 in 12	...	2	9	...	1	6	12	1
Intestines, . . .	1	...	9	1	...	...	1	...	4	...
Peritoneum, . . .	...	...	52	...	...	...	2	...	5	...
Testes, . . .	...	...	...	1	...	...	...	...	...	...
Bladder, . . .	...	...	8	...	...	...	...	1	5	...
Prostate, . . .	...	...	...	1	...	...	...	...	2	...
Tunica Vaginalis, .	...	...	1	...	...	...	...	...	...	...
Of Special Sense, .	1	...	...	..	...	...	...	...	3	...
TISSUES AFFECTED.										
Cellular tissue, . .	7	...	...	...	6	...	6	6	37	2
Skin, . . .	...	...	...	2	...	...	...	...	3	...
Muscles, . . .	...	1 in 15	3	4	...	...	...	1	10	...
Bones, . . .	...	...	...	2	...	...	...	...	1	...
Arteries, . . .	...	...	4	...	...	...	...	...	...	...
Veins, . . .	...	...	3	...	4	...	5	2	11	...

TABLE III.—*continued.*

CAVITIES AFFECTED.	AUTHORS MENTIONED BY—		
	Savory.	Cases reported in <i>Med. Times and Gazette</i> , vol. i. 1863.	Cases collected from various sources.
Thoracic cavity affected, ...	107	7	7
Do. not examined, ...	...	...	...
Do. not noted, ...	...	...	...
Do. healthy, ...	...	1	...
Cranial cavity affected, ...	4	...	...
Do. not examined, ...	...	...	...
Do. healthy, ...	...	...	...
Abdominal cavity affected, ...	52	5	...
Thoracic and abdominal cavities affected } together, ... }	...	5	7
Total number of each author's cases, . . .	110	18	21
ORGANS AFFECTED.			
Lungs, ...	53		
Heart, ...	18	11	7
Pleura, ...	20	3	1
Pericardium, ...	16	3	7
		...	4
Joints, ...	35	9	7
Blood-vessels, ...	...	...	1
Glands, ...	2	...	...
Liver, ...	18	6	...
Kidneys, ...	21	1	7
Spleen, ...	8	1	3
Intestines, ...	...	...	1
Peritoneum, ...	4	3	...
Testes, ...	1	...	...
Bladder, ...	1	...	...
Prostate, ...	4	2	...
Tunica vaginalis, ...	...	...	...
Of Special Sense, ...	3	...	...
TISSUES AFFECTED.			
Cellular tissue, ...	37	5	10
Skin, ...	...	...	3
Muscles, ...	11	1	1
Bones, ...	...	...	...
Arteries, ...	3	...	...
Veins, ...	20	5	4

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